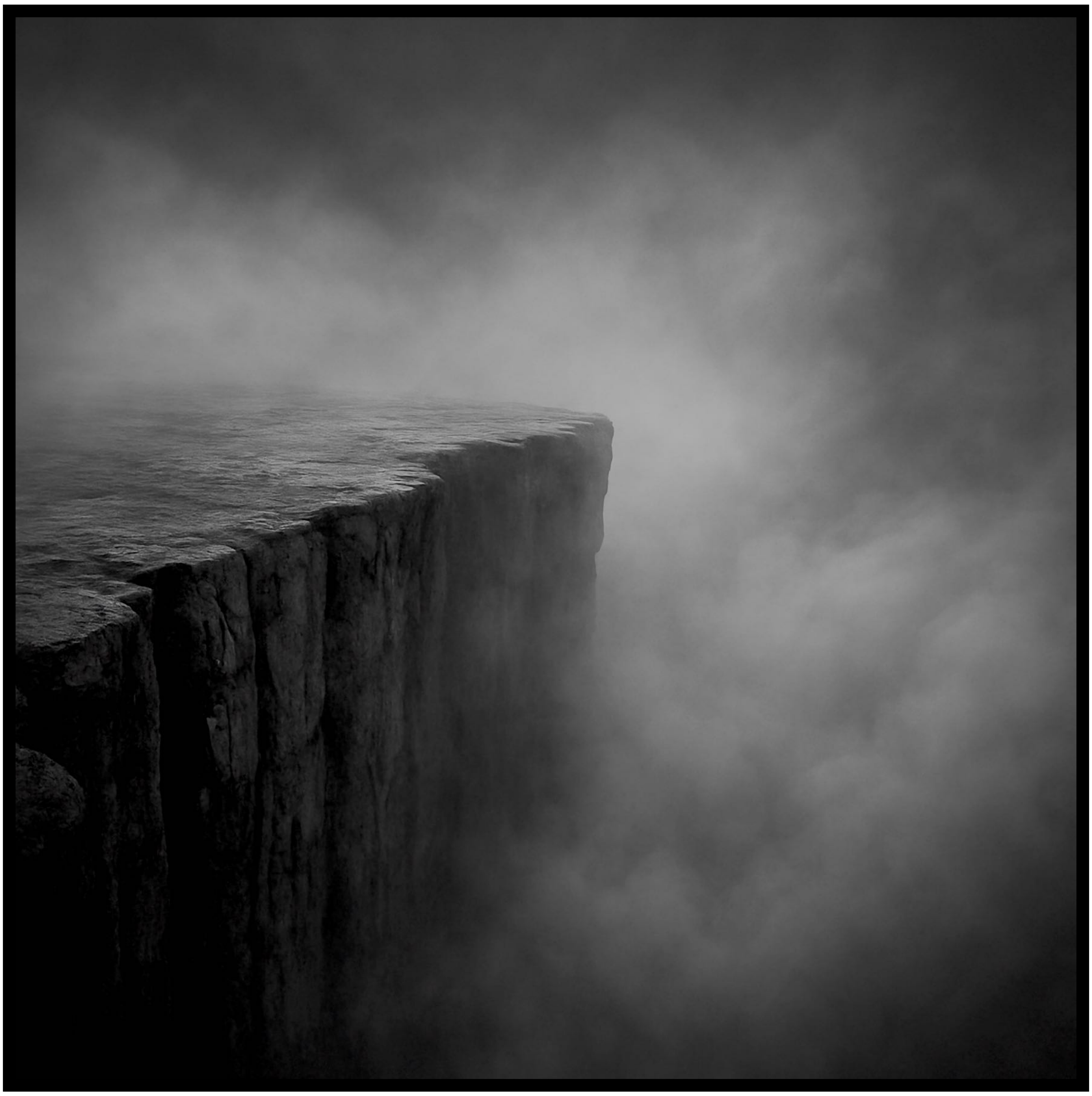
The Polycrisis

What It Is, and How to Deal With It



Mika Aaltonen & Alf Rehn

The Polycrisis – What It Is, and How to Deal with It
First Edition, 2025

ISBN 978-952-65716-8-3

CONTENT

PREFACE

Remember when the world was simpler? Remember when there were crises, but in an orderly fashion? One crisis at a time, clearly marked, easily named; you dealt with one before moving to another, and that was what life was. Executives learnt that crisis management was a special case, one with its own consultants and checklists, and the assumption was that crises were sorted sequentially, in an ordered fashion.

That was then, and this is now.

A now that is defined by seemingly endless crises, one leading into the next. Some would blame the pandemic, and the way it triggered economic disruption, social unrest, educational chaos, mental health crises, supply chain failures, and political instability. Others would lay blame at the new instability of geopolitics, where the old order is starting to look like halcyon times and people are looking back to the era of Clinton and Yeltsin with the kind of nostalgia normally afforded seminal rock albums.

Today, our expectations have changed.

Where we used to see crises as something to solve, now we increasingly see them as something that feeds into other crises, creating feedback loops and amplification effects that defy traditional crisis management approaches. Sure, there have been cases of multiple crises occurring simultaneously, but that no longer seems sufficient to describe what we're experiencing.

This is something qualitatively different. Not a crisis, nor a calamity of crises, but something stranger than all these – a polycrisis.

The term "polycrisis" has gained increasing attention among scholars, policymakers, and practitioners as we grapple with the reality that our modern, interconnected world faces challenges that cannot be understood or addressed in isolation. From climate change to technological disruption, from demographic transitions to geopolitical instability, the challenges of our time are fundamentally interconnected and require new ways of thinking and responding.

This book emerges from the recognition that our traditional approaches to managing crises, or managing really anything, can no longer lean on approaches designed for simpler times and more isolated challenges. In fact, the question increasingly is whether the very notion of management is up to scratch and adequate for the complex, interconnected crises of the 21st century. Instead, we need new frameworks, new tools, and new ways of thinking and organizing to engage with the polycrisis that increasingly defines our era.

Writing this book has in itself been a lesson in managing complexity and interconnection. Drawing from complexity science, systems thinking, network theory, and practical crisis management experience, we have sought to create a comprehensive guide that is both theoretically grounded and practically applicable.

Yet at the same time, this short book is also an experiment in utilizing AI for addressing such a complex issue. Much of this book has been created with systems such as Authormind, an AI tool consisting of several agents with diverse capabilities to assist us in ideation, editing, proofing and fact checking, and we wish to be completely transparent about this, even if we of course are fully responsible for all that is written here, as a result of our technological, linguistic and cognitive resources.

We did this to address the polycrisis, but also to acknowledge that the tools of yesteryear may no longer be enough to address the polycrisis of today.

In Helsinki and Copenhagen, Winter 2025

PART 1

Understanding the Polycrisis

CHAPTER 1

THE POLYCRISIS ERA

A Crack in the Global Economy

It is one thing to live in the world, it is an altogether different one to make sense of it.

Consider the following: In February 2021, Texas experienced an unusually severe winter storm. Temperatures plunged, the power grid faltered, and millions of people were left without heat or electricity. For most of the world, it was a brief story in the news cycle – just another example of climate volatility in a far-off place. Inside the global production network, however, that week would turn out to be far more consequential.

The storm did many things, but one key if overlooked one was that it forced the shutdown of petrochemical plants along the Gulf Coast. This included several responsible for producing a substantial share of the world's ethylene and propylene, compounds that are the basic feedstocks for modern plastics. What made the situation particularly serious was that restarting a petrochemical "cracker" is not a simple matter, but a complex, high-temperature, high-pressure system. When such a system goes offline unexpectedly, bringing it back online safely can take weeks or even months.

That delay had consequences.

As the shutdowns dragged on, global supplies of key plastic resins tightened dramatically. Manufacturers that depend on polypropylene, polyethylene, and related materials found themselves unable to source what they needed. What had begun as a regional weather anomaly was suddenly disrupting everything from automotive production to food packaging.

Shortages cascaded through the system. Without sufficient resin, companies struggled to produce pallets, shrink-wrap, containers, and countless other items normally taken for granted. Food producers were forced to adjust packaging formats. E-commerce warehouses adapted to inconsistent supplies of packing material. Logistics companies faced higher costs and operational delays. Most of us only noticed this in prices and delays in logistics, things we've gotten used to, but the effects were real and critical.

This shift also had a second-order effect: Demand for paper-based packaging spiked. Paper, however, is heavier and bulkier than plastic. Increasing its use placed additional strain on global freight networks already under pressure from the pandemic. Freight prices rose. Supply bottlenecks deepened. And as logistics costs surged, so did prices for everyday goods. By the end of the year, inflation was accelerating globally. Analysts pointed to energy prices, disrupted shipping, and labour shortages. All were true.

But buried inside that mix was a quieter, less visible cause: A cold week in Texas that had taken down a handful of highly concentrated petrochemical facilities.

This episode illustrates a central lesson of the polycrisis: Modern economies contain hidden chokepoints where small, localized shocks can amplify into global disruptions.

A failure in one region becomes a shortage elsewhere, which becomes a price spike somewhere else again. The world is tightly coupled, and the fragilities that matter most are often the ones we do not think to monitor. The Texas freeze did not, in itself, reshape the world economy. But it revealed how thin the margin of safety has become in critical industrial systems, and how easily a local disturbance can ripple outward with surprising force.

Beyond the Multiple (Crises)

The concept of polycrisis represents a fundamental shift in how we understand and respond to complex challenges. It is not simply about facing singular, critical crises, nor about dealing with multiple crises simultaneously.

Throughout history, societies have dealt with wars, natural disasters, economic troubles, and social upheavals happening at the same time, but as the world was less inter-connected, constructed with less overlaps, these were still less likely to create domino effects from minute perturbations.

There may have been multiples of crises, but they did not come together into a polycrisis. This is qualitatively different because it accepts and engages with the dynamic, interconnected nature of modern challenges:

- Crises in one domain can and will rapidly cascade into other domains.
- Solutions in one area may create or exacerbate problems in another.
- The interactions between crises can create new, emergent challenges.
- Traditional sectoral approaches to crisis management can act to power up other parts of the polycrisis.
- The pace and scale of interconnection outstrip our institutional capacity to respond.
- As our world becomes more interconnected, it also introduces new stresses and new points of fragility, and introduces what at least can seem like non-linear effects.

The Drivers of Modern Polycrisis

Several factors have converged to make the polycrisis the defining characteristic of 21st-century challenges:

- **Increased Interconnectedness:** Globalization has created unprecedented levels of economic, social, and technological interconnection. While this has brought many benefits, it has also created pathways for crises to spread rapidly across sectors and borders.
- **Technological Acceleration:** The pace of technological change has created new vulnerabilities and dependencies while outpacing our ability to understand and govern these new technologies effectively.

- **Environmental Limits:** Human activity has reached planetary boundaries in multiple domains, creating feedback loops between environmental degradation and social and economic systems.
- **System Complexity:** Modern societies are more complex than ever before, with intricate dependencies between infrastructure, institutions, and social systems that create opportunities for cascade failures.
- **Information Velocity:** The speed at which information travels in our digital age means that crises can spread faster than our ability to understand and respond to them.

The Inadequacy of Traditional Approaches

Traditional crisis management will still be needed, as part of greater systemic responses, but we also need to allow for the fact that its approaches were developed for a simpler world.

This was a world where the very notion of "managing" a crisis made sense, one where crises were more isolated, institutional responses could be more easily coordinated, and where the pace of change allowed for deliberate analysis and response.

Traditional approaches typically feature:

- **Sectoral organization:** Different government departments and agencies handle different types of crises.
- **Linear thinking:** Assuming that problems have identifiable causes and proportional solutions.
- **Reactive responses:** Mobilizing resources after problems become apparent.
- **Single-domain expertise:** Relying on specialists within particular fields.
- **Hierarchical coordination:** Top-down command and control structures.

While these approaches retain value in certain contexts, they prove inadequate when facing a polycrisis because they cannot capture the dynamic interactions, feedback loops, and emergent properties that characterize interconnected challenges.

Where we once tried to manage – as in control and steer – we today need to think in humbler terms. A polycrisis cannot be managed in any sensible use of the term, but it can be engaged with, responded to, faced, acknowledged, and met.

This will be more akin to dancing or parkour than managing, for better or worse.

The Promise of Complexity Science

Many would argue that comprehending and managing polycrisis requires insights from complexity science — the interdisciplinary study of complex adaptive systems.

Complexity science provides tools and frameworks for understanding how individual components interact to create system-level behaviors that cannot be predicted from studying components in isolation. Key concepts from complexity science that illuminate polycrisis include:

- **Emergence:** How interactions between system components create new properties and behaviors.
- **Self-organization:** How systems can adapt and reorganize without central control.
- **Network effects:** How the structure of connections influences system behavior.
- **Nonlinear dynamics:** How small changes can have large effects and vice versa.
- **Feedback loops:** How system outputs influence future inputs, creating reinforcing or dampening cycles.

By shifting our perspective from an engineering logic of problems and solutions to something more anthropological, where problems and solutions co-exists in a complex dynamic with the material world and our interpretations thereof, we might not solve a polycrisis as such – but we will be better positioned to make sense of it.

A Note on Uncertainty

One of the fundamental characteristics of polycrisis is uncertainty. Not just about specific outcomes, but about the nature of the challenges themselves.

This book does not pretend to offer simple solutions or certain predictions. Instead, it is written to provide some frameworks, tools, and approaches that can help navigate uncertainty and complexity more effectively.

Our goal is not to eliminate uncertainty, which is impossible in complex systems, but to develop capabilities for learning, adapting, and responding effectively in the face of uncertainty.

This requires intellectual rigorousness, experimental approaches, and a willingness to continuously update our understanding as new information becomes available, no matter how well we think we have mastered complexity science.

Checking Back With Texas

So, if the Texas freeze teaches us anything, it is that preparing for the next disruption cannot rely on the old playbook of risk management and contingency planning.

A polycrisis does not wait patiently in a risk register, nor does it respect sector boundaries. The shock to petrochemical production was not, at root, a failure of energy infrastructure, nor a failure of industrial design, nor a failure of logistics. It was the interaction between them, the way a weather anomaly intersected with a concentrated and highly optimized production system, and how that system then transmitted stress outward into entirely different domains.

Preparing for the next cold snap, then, requires a different kind of posture. Not better foresight alone, but a more expansive way of perceiving hidden dependencies and potential pathways of disruption. Several principles follow from this.

1. **We must learn to see the chokepoints that do not announce themselves.** The ethylene and propylene facilities along the Gulf Coast were not unknown, but their systemic importance was largely invisible until they failed. Organizations must develop the capacity to map their dependencies not just to direct suppliers, but deep into the underlying materials and infrastructures that make those suppliers viable. This is less a supply-chain exercise and more

a form of systems literacy: Understanding where the leverage points and brittle nodes reside, even when outside one's formal domain.

2. **Redundancy must be understood as an investment rather than an inefficiency.** Highly optimized global production systems have been built on assumptions of stability that no longer hold. Concentration lowers cost until the day it magnifies failure. Resilience, in a polycrisis world, is not about building excess capacity everywhere, but about identifying where a lack of redundancy creates systemic amplification. Some vulnerabilities are acceptable; others can drive global inflation. Knowing the difference is now a strategic task.
3. **Organizations need to cultivate faster, more flexible modes of response.** In a tightly coupled system, delays matter. The longer it takes to detect a disruption, the more time it has to propagate. This is where the traditional crisis-management model falters: it activates after a problem is fully visible, by which point second- and third-order effects are already in motion. What is needed instead is distributed sensing and the ability to pick up weak signals, anomalies, and early indicators long before a shock becomes a headline.
4. **We must accept that some disruptions cannot be prevented, only absorbed.** No amount of planning can stop a cold front, nor ensure that every industrial facility can be winterized to extremes that once seemed improbable. But what can be improved is our capacity to absorb and adapt. This involves building organizational practices that allow for rapid reconfiguration, alternative sourcing, and flexible operational modes. It also involves the humility to understand that not every shock can be managed, and well as the wisdom to see that many can be buffered.
5. **Finally, the lesson is not about Texas at all. It is about the structure of modern life.** The petrochemical facilities could just as easily have been semiconductor fabs, undersea cables, fertilizer plants, or cloud data centers. The particulars change, but the pattern remains: a local stressor interacts with a concentrated system; that system transmits the disturbance outward; the disturbance becomes a broader economic or social shock. Preparing for the next cold snap is, ultimately, preparing for any such event.

In a polycrisis, resilience is not the ability to stand firm against every storm, but the capacity to move with complexity rather than against it.

The Texas freeze was a reminder that our systems are deeply interdependent and often more fragile than we admit. It was also an invitation to build differently. Not in the sense of attempting to control the world, but to live more intelligently within it.

Who This Book Is For

We have written this book for multiple audiences who must navigate the challenges above:

- Policymakers and Government Officials who need frameworks for understanding and responding to interconnected challenges that cross traditional departmental boundaries.
- Business Leaders who must navigate increasingly complex and interconnected risks while building organizational resilience.
- Civil Society Organizations that work on complex social challenges and need tools for understanding how their work connects to broader systems.
- Academics and Researchers who study complex systems, crisis management, and social change.
- Concerned Citizens who want to understand the complex challenges facing our world and how they can contribute to solutions.

These people are central, because as we write this the world continues to grapple with new instantiations of the polycrisis; figurations emerging from climate change, technological disruption, geopolitical instability, social inequality, or just a cold spell. In such a situation, the urgency of developing better approaches to dealing with the polycrisis has never been greater.

At the same time, we are also witnessing remarkable innovations in crisis response, from rapid vaccine development to new forms of international cooperation to grassroots community resilience initiatives. These innovations point toward the possibility to build more resilient, adaptive, and equitable systems.

The choice before us is clear.

We can continue to apply 20th-century approaches to 21st-century challenges and watch as our problems grow more complex and intractable, or we can embrace new ways of thinking and organizing that are adequate to the complexity of our time.

This book is an invitation to choose the latter path — to develop the intellectual tools, practical capabilities, and institutional innovations needed to thrive in the age of the polycrisis.

CHAPTER 2

THE NEW REALITY OF INTERCONNECTED CRISES

Your Computer and Dutch Manure

In the summer of 2022, the Netherlands found itself in a heated national dispute over nitrogen-emission rules.

The problem was, quite literally, manure. Dutch agriculture is highly intensive, and livestock farming produces large quantities of ammonia-rich waste. When new emission limits were introduced to comply with European court rulings, farmers responded with anger, fear, and tractors. Lots and lots of tractors. To most observers, this was a domestic environmental-policy conflict. What few recognized at the time was that these protests briefly touched one of the most critical nodes in the global economy: the supply chain for cutting-edge semiconductors.

Among the facilities affected by road blockades and transport disruptions was ASML, a company located in Veldhoven and responsible for producing the world's only extreme ultraviolet (EUV) lithography machines.

These machines are not just expensive; they are foundational to modern technological progress. Without EUV systems, the most advanced chips cannot be made. And without advanced chips, everything from smartphones and medical devices to artificial intelligence systems stalls. ASML depends on a continuous flow of highly specialized components and a steady movement of employees, suppliers, and logistics partners. The protests, however, created moments where roads were blocked by tractor convoys, slurry tanks, hay bales, and mounds of literal manure dumped across highways. What had begun as an argument about environmental regulation was now delaying the world's most sophisticated manufacturing equipment. This was not because farmers intended to disrupt semiconductor production, nor because ASML was central to the public debate. Rather, it happened because modern systems are tightly coupled. A handful of blocked intersections can alter delivery schedules for machines that take months to assemble and years to perfect. Even a short delay can ripple outward, slowing chip production schedules in Asia, delaying product launches elsewhere, and tightening already strained supply chains. The episode illustrates a core dynamic of the polycrisis: small disturbances in one domain can interact with structural concentrations in another, amplifying effects far beyond their point of origin. In earlier eras, agricultural protest and semiconductor production would have belonged to entirely separate worlds. In the 21st century, they share infrastructural pathways, and a political dispute about nitrogen becomes entangled with the global race for technological advantage. One could say this was the moment manure became a geopolitical input.

A local protest became a reminder that no domain operates in isolation, and that fragilities often lie hidden in the places we least expect. The semiconductor industry's future did not hinge on new materials or breakthrough physics during those days in 2022. It hinged, instead, on whether a convoy of farmers would allow delivery trucks through, and whether the roads were clear of manure.

Sometimes, all that is needed for a global crisis is just the right pile of shit on just the right highway.

The Evolution of Crisis Concepts

To understand the polycrisis, it is imperative we first examine how our understanding of crises has evolved over time, and to do so we need to start from the very beginning.

The word crisis comes from the Greek *krisis,* meaning decision or turning point. Traditionally, crises were understood as discrete events that disrupted normal functioning and required decisive response to restore stability. This understanding served well for much of human history, when societies were less interconnected and challenges could often be addressed within clear boundaries – be they then geographic, sectoral, temporal, or something else.

A natural disaster affected a particular region, an economic downturn could be addressed through fiscal policy, or a political crisis could be resolved through institutional mechanisms.

As societies became more complex and interconnected, particularly in the latter half of the 20th century, scholars and practitioners began to recognize that this traditional understanding was increasingly inadequate for many contemporary challenges.

From Crisis to Polycrisis

The evolution of crisis concepts can be traced through a number of key stages:

- **Traditional Crisis Management** (Pre-1970s) focused on discrete, manageable events with clear beginnings, middles, and ends. Responses were typically reactive, hierarchical, and sectoral.
- **Complex Emergency** (1980s-1990s) emerged as humanitarian organizations encountered situations where multiple factors (conflict, economic collapse, environmental degradation, and social breakdown) combined to create protracted crises that defied traditional humanitarian response models.
- **Wicked Problems** (1970s-present) described by Horst Rittel and Melvin Webber, referred to policy challenges that are difficult to define, have no clear solutions, and where each problem is essentially unique.
- **Systemic Risk** (2000s-present) emerged from financial sector analysis to describe risks that threaten the entire financial system rather than individual institutions.
- **Polycrisis** (2010s-present) represents the latest evolution in crisis thinking, capturing the reality of multiple, interconnected crises that interact in complex ways to create new challenges.

Towards a Formal Definition of Polycrisis

Based on current usage in academic literature and policy discourse, we define polycrisis as:

> A dynamic condition where multiple crises interact across different domains (social, economic, environmental, political, technological) creating cascading effects, feedback loops, and emergent challenges that exceed the sum of individual crisis impacts and overwhelm traditional crisis management approaches.

This definition highlights several key elements:

- **Multiple Crises:** Polycrisis involves more than one crisis occurring simultaneously, but this multiplicity is not merely additive.
- **Cross-Domain Interaction:** The crises span different sectors or domains of society and interact across these boundaries.
- **Dynamic Processes:** Polycrisis is not a static condition but involves ongoing processes of interaction, evolution, and emergence.
- **Cascading Effects:** Disruptions in one area trigger impacts in other areas through interconnected systems.
- **Feedback Loops:** The effects of crises can reinforce or dampen the original crises or create entirely new ones.
- **Emergent Properties:** The interaction of multiple crises creates new challenges that could not be predicted from understanding the individual crises alone.
- **System Overwhelm:** The complexity and interconnectedness of polycrisis exceeds the capacity of traditional institutional responses.

Distinguishing Polycrisis from Related Concepts

Understanding what polycrisis is requires understanding what it is not. Several related concepts are often confused with or conflated with polycrisis:

- Multiple Independent Crises occur when several crises happen simultaneously but do not significantly interact. For example, a volcanic eruption in one region and a political crisis in another unconnected region. While both require crisis response, they do not create the interactive dynamics characteristic of polycrisis.
- Sequential Crises involve one crisis following another, often with the first crisis contributing to the second. For example, an earthquake triggering a tsunami, or an economic recession leading to political instability. While sequential crises may involve some interaction, they lack the simultaneous, multi-domain interaction of polycrisis.
- Compound Crises involve multiple factors contributing to a single crisis outcome. For example, a hurricane affecting a region already weakened by economic decline. While compound crises involve multiple factors, they typically focus on a single primary crisis rather than the multi-domain interactions of polycrisis.
- Complex Emergencies typically focus on humanitarian situations involving conflict, economic collapse, and social breakdown. While complex emergencies share some characteristics with polycrisis, they are typically geographically bounded and focus primarily on humanitarian outcomes.

- Wicked Problems are policy challenges that are difficult to define and solve, but they do not necessarily involve the acute crisis dynamics and rapid evolution characteristic of polycrisis.

The Dimensions of a Polycrisis

Polycrisis can be comprehended along several key dimensions that help us analyze specific instances and develop appropriate responses:

- The Temporal Dimension
    - **Acute vs. Chronic:** Some polycrises involve rapidly evolving acute challenges, while others develop slowly over long time periods.
    - **Synchronous vs. Asynchronous:** Crisis components may evolve at the same pace or at different speeds.
    - **Duration:** Polycrises may be short-lived or persist for extended periods.
    - **Cyclical vs. Linear:** Some polycrises exhibit cyclical patterns while others follow more linear trajectories.
- The Spatial Dimension
    - **Geographic Scale:** From local to global in scope.
    - **Boundary Crossing:** The extent to which crises cross jurisdictional boundaries.
    - **Core-Periphery Dynamics:** Whether crisis impacts are concentrated in particular areas or widely distributed.
    - **Network Topology:** The spatial structure of connections that enable crisis propagation.
- The Sectoral Dimension
    - **Domain Scope:** Which sectors (economic, political, social, environmental, technological) are involved.
    - **Cross-Sector Dependencies:** The nature and strength of connections between different sectors.
    - **Critical Infrastructure:** The role of physical and institutional infrastructure in crisis propagation.
    - **Sectoral Resilience:** The relative vulnerability of different sectors to crisis impacts.
- The Social Dimension
    - **Population Groups:** Which populations are most affected and how impacts vary across social divisions.
    - **Institutional Capacity:** The ability of institutions to respond effectively.
    - **Social Cohesion:** How polycrisis affects social trust and solidarity.
    - **Power Dynamics:** How existing power relationships influence polycrisis dynamics and responses.

The Spectrum of Crisis Interconnection

Not all situations involving multiple crises constitute a polycrisis.

Crisis interconnection exists on a spectrum, and understanding where a particular situation falls on this spectrum is important for determining appropriate responses:

- **Low Interconnection:** Multiple crises occur simultaneously but have minimal interaction. Traditional crisis management approaches may be adequate if scaled appropriately.

- **Moderate Interconnection:** Crises have some interactions, typically through shared resources, infrastructure, or institutions. Coordination mechanisms become important, but existing institutions may be able to adapt.
- **High Interconnection:** Crises are strongly interconnected through multiple pathways, creating significant feedback loops and emergent effects. Traditional approaches are likely to be inadequate, and new approaches are needed.
- **Extreme Interconnection:** Crises are so tightly coupled that they cannot be meaningfully separated. The distinction between individual crises becomes meaningless, and entirely new frameworks may be required.

Identifying Polycrisis in Practice

Key indicators in recognizing when a situation constitutes polycrisis (rather than multiple independent crises) include:

- **Cross-Sector Impacts:** When events in one sector rapidly produce significant effects in other sectors.
- **Feedback Amplification:** When responses to one crisis make other crises worse or create new problems.
- **Resource Competition:** When crisis responses compete for the same limited resources, creating trade-offs and difficult choices.
- **Institutional Overwhelming:** When existing institutions cannot cope with the complexity and pace of interconnected challenges.
- **Emergent Challenges:** When new problems arise that were not predictable from understanding individual crisis components.
- **Solution Resistance:** When attempted solutions fail because they do not account for system-level interactions.

Did our Dutch example live up to this?

Arguably, it fulfills the first three indicators without a hitch. It also serves as an excellent example of emergent challenges, as few people had even considered the chance that rules regarding manure in the Netherlands could be a risk to chip production in Asia. What doesn't fit neatly is that the institutions weren't overwhelmed, nor was the solution all that far away.

In the end, the Dutch manure–chip crisis did not resolve through any grand technical fix or sweeping redesign of supply chains.

It eased because the immediate disruptions faded: police cleared blockades, companies like ASML quietly rerouted shipments and adjusted schedules, and the government softened the harshest edges of its nitrogen policy. Protest momentum waned, political negotiations absorbed the conflict, and traffic around key industrial zones returned to something resembling normal.

Like the Texas freeze, the crisis passed not because the underlying fragilities were addressed, but because the acute stressor lifted. What looked like resilience was, in truth, a temporary alignment of circumstances that allowed the system to keep moving without breaking.

The Historical Context of Polycrisis

While the term polycrisis is relatively new, the phenomenon it describes has historical precedents:

- **The Great Depression** (1930s) involved economic collapse that triggered political instability, social unrest, and international conflict, demonstrating how economic crises can cascade across multiple domains.
- **World War II** (1940s) created a global polycrisis involving military conflict, economic disruption, social upheaval, technological transformation, and humanitarian catastrophe.
- **The Oil Crises** (1970s) showed how energy disruptions could rapidly propagate through economic, political, and social systems, creating widespread instability.
- **The End of the Cold War** (1989-1991) demonstrated how political transformation could trigger economic, social, and security challenges across multiple regions.
- **The 2008 Financial Crisis** illustrated how problems in one sector (financial services) could rapidly spread through interconnected global systems.

However, what makes contemporary polycrisis distinctive is the unprecedented level of global interconnection, the speed of information and crisis propagation, the complexity of modern technological systems, and the scale of human impact on planetary systems.

The Importance of Definitional Clarity

We are here aiming to be fairly thorough with our definition of a polycrisis.

This is not merely an academic exercise. It has practical implications for how we organize our responses to complex challenges:

- **Resource Allocation:** Understanding whether we face polycrisis or multiple independent crises affects how we prioritize and allocate scarce resources.
- **Institutional Design:** Different types of crisis situations require different institutional responses and coordination mechanisms.
- **International Cooperation:** The need for and nature of international cooperation varies depending on the interconnectedness of challenges.
- **Public Communication:** How we explain complex challenges to the public affects their understanding and support for necessary responses.
- **Research Priorities:** Different conceptualizations of crisis lead to different research questions and methodological approaches.

As we move forward in this book, we will build on this foundation to explore the characteristics of polycrises in greater detail, examine specific examples, and aim to develop frameworks and tools for more effective response.

CHAPTER 3

FONIC – THE POLYPHONIC POLYCRISIS

The Polycrisis is Poly-FONIC

As Jane Austen might have put it: "It is a truth universally acknowledged, that men in the process of writing a book, must be in want of a framework with an acronym."

In our case, this framework, or heuristic, is FONIC.

We will define it below, but the acronym carries a secondary meaning. Just like a polycrisis is a bundle or a cluster of crises, we need to acknowledge that our current world consists of many voices, many tales. It is, in a word, polyphonic. This can, at times, seem a problematic thing; polyphony can sound like a din or like a racket.

However, to address a polycrisis we need something more than yesterday's belief in one voice and one truth. We need the polyphony, which is why we wanted to note this (if with a quick of spelling to make it work) in the name of our framework

FONIC stands for
Fragile – Overlapping – Nonlinear – Interconnected – Cascading

The FONIC framework aims to capture the defining characteristics of the polycrisis era. It is not a risk taxonomy or a management model in the traditional sense, but a way of perceiving modern systems in order to understand why disruptions spread so quickly and unpredictably. FONIC helps leaders see where vulnerabilities originate, how they propagate, and why standard crisis responses fail to contain them.

Fragile: Systems optimized for efficiency often sacrifice buffers, redundancies, and slack. This creates brittle structures where small perturbations can produce operational breakdowns.
Examples: Texas petrochemical freeze; just-in-time supply chains; concentrated semiconductor manufacturing.

Overlapping: Multiple systems, and their respective pressures, sit atop one another. Environmental policy intersects with agriculture, which intersects with industrial logistics, which intersects with global technology pathways.
Examples: Dutch nitrogen rules colliding with chip-supply routes; water scarcity shaping energy and agriculture simultaneously.

Nonlinear: Cause and effect no longer scale proportionally. A minor disruption can have outsized impacts, while major interventions sometimes yield only marginal improvements.
Examples: A frozen valve in Texas raising global polypropylene prices; small policy shifts triggering large protest waves.

Interconnected: Local shocks cannot be contained. Systems are bound together through supply chains, data flows, infrastructure, ecological dependencies, and political dynamics.
Examples: A conflict over manure emissions affecting ASML's logistics; a single shipping blockage in the Suez Canal affecting global trade flows.

Cascading: Disruptions propagate across domains, generating second- and third-order consequences that are often unanticipated and difficult to reverse.
Examples: Petrochemical shortages → packaging shortages → freight distortions → inflation spikes; protests → logistics disruptions → chip delays → global tech ripple effects.

What's the point of all this, you may ask?

What we hope a framework such as FONIC can do is that it shifts attention from isolated risks to dynamic relationships. It helps leaders recognize not only where a system may fail, but how failure will travel. It reframes resilience away from "control and predict" and toward sensing, buffering, adaptability, and humility in the face of complexity. In the following we will look at this in some more detail.

The Architecture of Fragility

Fragility is the foundational condition that allows small disturbances to become disproportionately harmful within modern systems.

It is not merely the presence of weaknesses, but the systematic removal of buffers, redundancies, and adaptive capacities that once allowed societies to absorb shocks.

Fragility arises when systems are optimized for efficiency, speed, and precision to such an extent that they lose the flexibility required to withstand unexpected stress.

This operates through multiple mechanisms and becomes visible across several domains.

Optimization-Driven Vulnerabilities

Modern production and logistical systems are designed to minimize cost and maximize efficiency, often through practices like just-in-time inventory, concentrated manufacturing, and globalized sourcing.

These optimizations reduce slack to the point where even minor disruptions can have outsized effects.

Consider the Great Glitter Shortage: In 2018–2020, global manufacturers began experiencing a glitter shortage when one of the world's largest and most secretive U.S. producers faced production constraints amid rising costs and upstream shortages in aluminum and PET film. Industries from cosmetics to marine coatings to aerospace suddenly felt the impact, revealing how deeply this niche material was embedded in their processes.

When systems are optimized to the edge of feasibility, shocks anywhere along the chain expose their underlying brittleness.

Concentration of Critical Functions

Fragility also emerges from the clustering of essential capabilities in a small number of locations, firms, or infrastructural nodes.

Semiconductor manufacturing, rare-earth processing, petrochemical refining, and fertilizer production are all heavily concentrated sectors, and this concentration creates single points of failure.

Today, a scary amount of critical infrastructures depends on five cloud providers: Amazon Web Services, Microsoft Azure, Google Cloud Platform, Alibaba Cloud, and Oracle/IBM Cloud (separate but partnered). A major outage in any one of these would affect a broad swath of digital service, with cascading results.

When critical functions depend on narrow chokepoints, fragility becomes a structural feature rather than an occasional risk.

Erosion of Redundancies and Safety Margins

Systems that once possessed built-in slack – reserve capacity in power grids, stockpiles of essential materials, diversified supplier networks – have gradually shed these safeguards in pursuit of efficiency.

The result is a narrowing margin of error.

Weather anomalies, supply delays, or political disruptions that previously would have been manageable now cascade through systems with little resistance. The rolling shortages seen during the COVID-19 pandemic, from medical equipment to microchips, were amplified not only by demand surges but by the absence of meaningful reserves.

Invisible Dependencies and Assumptions

Fragility is often hidden because it grows out of assumptions that rarely appear in public discourse. Systems are built on expectations of predictable climate conditions, stable geopolitical relations, and uninterrupted flows of energy, information, and materials. When these assumptions fail – as they increasingly do – the fragility embedded within the system becomes visible. The Texas freeze did not simply reveal an engineering oversight; it exposed the deeper assumption that weather patterns would remain consistent enough to justify minimal winterization. As global warming is giving rise to more and more weather anomalies, these kinds of assumptions will be put to the tests. Fragility, in this sense, is the result of assumptions that have quietly expired.

The Consequence of Fragility

When fragility permeates infrastructure, supply chains, or institutions, the likelihood that a single disturbance will produce cascading effects increases sharply. Fragile systems do not absorb shocks; they transmit them. They convert local disruptions into systemic stress.

In the context of a polycrisis, fragility is not just a vulnerability but a multiplier – a condition that ensures that shocks are rarely contained and often amplified.

Appreciating fragility, therefore, is not about identifying isolated weaknesses but about recognizing how the pursuit of efficiency has inadvertently constructed systems that function beautifully under ideal conditions and fail dramatically under stress.

The Layered Lives of Modern Crises

Overlapping refers to the way multiple systems, pressures, and crisis dynamics sit on top of one another in contemporary life, often without any clear boundaries between them.

Modern societies are not built from discrete, separate domains – economic, environmental, political, technological – but from interwoven layers whose interactions create conditions neither intended nor easily managed.

The world is, in effect, a layer cake, where each part holds the others together.

Crises no longer travel along a single pathway. They move through stacked systems that share interfaces, resources, and vulnerabilities. This layering is one of the key mechanisms that turns local disturbances into polycrisis dynamics.

Converging Policy and Material Systems

Overlaps emerge when policies shaped in one domain reshape vulnerabilities in another.

Consider Europe's energy transition efforts. Regulations intended to accelerate decarbonization altered market incentives across multiple sectors simultaneously: Shutting down coal plants, increasing gas dependency, and driving demand for renewables whose components rely on minerals mined elsewhere.

When Russia invaded Ukraine in 2022, energy security, carbon policy, fertilizer markets, and food systems became entangled overnight. A geopolitical shock collided with an environmental transition, which collided with global commodity markets.

These systems were not merely connected – they were layered, each influencing the stability of the others.

Stacked Technologies Creating Shared Exposure

Many contemporary technologies are built atop shared platforms – cloud providers, AI models, semiconductor architectures, communication protocols.

This technical overlapping means that a disruption in one layer reverberates across all dependent layers.

When a major content delivery network experienced a configuration error in 2021, news sites, payment systems, logistics platforms, and government portals went offline within minutes. These institutions had nothing in common except reliance on the same infrastructural substrate.

Overlapping digital systems collapse not like a line of dominoes (an image of the ordered, sequential crises of yesteryear), but like a building whose floors rest on the same cracked pillar.

Socioeconomic Layers Reinforcing One Another

Overlapping also occurs in social systems where economic inequality, housing insecurity, and health disparities become mutually reinforcing.

During the COVID-19 pandemic, communities with limited access to healthcare were also those most exposed to frontline work, crowded housing, and environmental hazards.

Each layer – economic precarity, occupational risk, healthcare access, local pollution – amplified the others.

Environmental and Infrastructural Overlays

Environmental pressures increasingly overlap with infrastructure that was never designed for the climate in which it now operates.

Rising river temperatures in France forced nuclear power plants to reduce output because discharge water risked harming ecosystems downstream. Heat waves that buckle rail lines also increase electricity demand for cooling, even as they reduce the efficiency of power plants and transmission lines.

Climate stress is not an isolated environmental factor – it sits directly atop critical infrastructure, meaning that environmental and infrastructural risks merge into a single, layered vulnerability.

The Consequence of Overlapping

When systems overlap, failures rarely stay confined.

A disruption in one layer activates pressures in another, creating multi-domain crises where it becomes difficult to distinguish cause from effect.

Overlapping transforms linear problems into complex patterns of entanglement, where interventions in one area can unintentionally destabilize another.

It is this layering that gives polycrisis its distinctive texture: events do not merely connect; they compound.

Modern crises stack, domains blend into one another, and managing a single issue in isolation becomes increasingly impossible.

On Infrastructures and Interconnectedness

The most fundamental characteristic of polycrisis is interconnectedness, i.e. the dense web of relationships, dependencies, and interactions that link different crisis components together.

This interconnectedness operates through multiple mechanisms and at multiple scales, as we will show below.

Physical Infrastructure Dependencies

Modern societies rely on intertwined physical infrastructures — power grids, water systems, transportation networks, communications — creating hidden highways through which crises can propagate. When one network fails, it often pulls others down with it. Blackouts don't just mean darkness; they knock out water treatment, disable transit, stop communications, disrupt hospitals, and halt commerce.

One brilliantly odd but entirely real example comes from **2023 in Adelaide, Australia**, where a booming colony of native fruit bats (the Grey-headed flying fox) living in an urban park began causing repeated power outages by roosting on overhead lines and infrastructure.

What started as a natural wildlife phenomenon transformed into a full-blown infrastructure failure: entire neighborhoods lost electricity, critical services were disrupted, and utility operators scrambled to install protective "bat guards" on power poles to stop the blackouts.

This case reveals what researchers mean by "system-of-systems" vulnerabilities: Each infrastructure network may be robust in isolation, but once connected, a disruption in one – even from something as small (or furry) as bats – can cascade through the rest.

What might seem like a local nuisance becomes a city-wide power catastrophe.

So when we celebrate efficiency and interconnectedness, we also magnify the potential for failure. A small bat colony in a park becomes a stress-test for the entire urban supply grid.

Not to mention a reminder that fragility sometimes wears wings.

Economic and Financial Linkages

Economic interconnectedness creates particularly powerful pathways for crisis propagation. Global supply chains mean that disruptions in one region can rapidly affect production and consumption worldwide.

The 2011 earthquake and tsunami in Japan disrupted global automobile production for months because of dependencies on specialized components manufactured in the affected region.

Financial systems create even more rapid pathways for crisis propagation.

The 2008 financial crisis demonstrated how problems with subprime mortgages in the United States could trigger a global financial crisis within weeks through interconnected financial markets, banking relationships, and credit dependencies.

Information and Communication Networks

The speed and reach of modern communication systems create new forms of crisis interconnectedness.

Information about crises can spread faster than the crises themselves, creating panic responses that amplify crisis impacts. Social media platforms can rapidly disseminate both accurate information and misinformation, affecting public behavior and institutional responses.

The COVID-19 pandemic illustrated both positive and negative aspects of information interconnectedness. Rapid sharing of scientific information accelerated vaccine development, but misinformation about the virus and vaccines also undermined public health responses.

Social and Political Dependencies

Social and political systems create interconnections through shared institutions, common resources, and interdependent relationships.

Political instability in one region can trigger migration flows that create social and economic pressures in other regions. Social unrest can undermine economic confidence and political legitimacy, creating feedback loops that amplify initial problems.

The Arab Spring demonstrated how political crises could propagate across national boundaries through social networks, shared grievances, and demonstration effects.

What began as protests in Tunisia spread rapidly across the Middle East and North Africa, creating a regional polycrisis involving political upheaval, economic disruption, social conflict, and humanitarian emergencies.

Environmental and Ecological Connections

Environmental systems create interconnections that operate at multiple temporal and spatial scales. Climate change affects weather patterns globally, creating risks for agriculture, water resources, coastal communities, and ecosystem stability. Environmental degradation in one region can affect neighboring regions through shared watersheds, air currents, and ecological systems.

The Australian bushfires of 2019-2020 illustrated environmental interconnectedness by affecting air quality across the Pacific, contributing to global climate change through carbon emissions, disrupting global supply chains for specific commodities, and creating feedback loops with climate patterns that increased future fire risks.

Where the Line Breaks: The Nonlinear Life of Crises

Nonlinearity is the feature of polycrisis that most disrupts our intuition.

It describes systems where causes and effects do not scale proportionately and to our minds behave illogically – where minor disturbances can produce outsized consequences, and where monumental efforts may yield only incremental change.

In nonlinear environments, the relationship between input and output is elastic, unstable, and often surprising.

Polycrises are shaped by nonlinear dynamics because they unfold within systems operating near thresholds, governed by feedback loops, and populated by adaptive agents whose responses reshape the conditions of the crisis itself.

Thresholds Hiding in Plain Sight

Nonlinear systems often absorb stress quietly until a tipping point is reached, after which change accelerates dramatically. These threshold effects are familiar in climate science — ice sheets that melt slowly until they suddenly collapse — but they manifest just as vividly in the mundane workings of modern infrastructure.

London's notorious 2017 *fatberg* illustrates this perfectly.

For years, congealed grease and wet wipes accumulated unnoticed beneath the city, creating no visible impact. Then, almost overnight, a 130-ton mass threatened to rupture Victorian sewer tunnels and shut down adjoining neighborhoods. A system that seemed stable simply flipped states.

Nonlinearity is this capacity for suddenness: The moment an invisible buildup becomes unmanageable.

Amplifiers and Dampeners in Motion

Nonlinear systems contain both mechanisms that accelerate crises and mechanisms that contain them. Which side dominates depends on context, timing, and the adaptive choices made by actors embedded within the system.

During Iceland's Eyjafjallajökull eruption in 2010, the ash cloud grounded European flights. What transformed a local geological event into a global economic disturbance was the amplification mechanism of air-cargo dependency. Kenyan flower farms – about as far from Iceland's *eldfjöll* as you can get – were forced to destroy millions of roses because export flights ceased.

Meanwhile, institutional dampeners such as diversified shipping networks could do little because perishable goods cannot wait. It is the interplay of amplification and dampening that makes nonlinear crises both unpredictable and uneven.

Power Laws and the Frequency of the Extreme

Nonlinear systems frequently exhibit power law behavior, where extreme events are not outliers but regular features of the system's operation.

Market crashes, viral misinformation cascades, and abrupt ecological shifts follow distributions in which rare events are far more common than traditional models assume.

This means that planning for "normal" volatility misses the fundamental character of these systems. In nonlinear worlds, the improbable is routine, and catastrophic events occupy the same statistical family as the mundane.

Sensitive Dependence on Initial Conditions

The classic "butterfly effect" (a small difference leading to large consequences) is not a poetic metaphor but a working descriptor of nonlinear dynamics.

In June 2015, a squirrel managed to creep into a substation operated by Pacific Gas & Electric (PG&E) in El Cerrito, California.

According to the utility, the animal damaged critical equipment which knocked out power for roughly 45,000 residents across multiple East-Bay cities. The blackout lasted for hours, and though power was restored, the incident revealed how a tiny animal could disrupt the electricity supply for tens of thousands, causing cascading inconvenience to households, traffic signals, businesses, and services.

In polycrisis environments, similarly small differences in timing, sequencing, or public behavior can determine whether an intervention stabilizes a situation or inadvertently accelerates it.

The Consequence of Nonlinearity

Nonlinearity undermines prediction, complicates planning, and punishes overconfidence.

It ensures that crises do not scale smoothly or respond neatly to intervention. Understanding nonlinearity means recognizing that systems do not merely bend under pressure; they jump, stall, or transform entirely.

It is the property of the polycrisis that makes outcomes disproportionate, responses precarious, and surprises inevitable. In this sense, nonlinearity is not simply a feature of modern crises; it is the dynamic through which fragility and overlapping systems become capable of producing entirely unexpected consequences.

Cascading Crises: Everything Everywhere All at Once

Our final stop, which in effect is often just the first one of a much bigger crisis, is the cascade.

This refers to the movement of disruptions across boundaries (be they institutional, infrastructural, geographic, or social) as crises migrate from one domain to another and evolve along the way.

A cascade is not a chain reaction in the mechanical sense. It is a transformation process.

As a crisis travels, it interacts with the systems it enters, acquiring new characteristics, triggering new vulnerabilities, and accelerating in ways that defy linear understanding. Cascading dynamics give the polycrisis its reach: crises do not stay where they begin because modern systems are configured for transmission rather than containment.

From Local Disturbance to System-Wide Stress

Cascades begin when a localized disruption jumps into a broader network.

In 2008, when an undersea cable snapped off the coast of Alexandria, much of India, the Gulf, and East Africa experienced internet slowdowns of up to 70%.

What looked like a minor physical failure became a global commercial event: Financial desks improvised latency workarounds, call centers rerouted operations, and emergency bandwidth auctions spiked prices overnight.

The episode revealed a simple truth: when systems depend on shared channels, even narrow failures can propagate widely.

Crossing Domains, Changing Shape

As crises migrate, they often shift forms.

Consider the 2022 fire at one of Europe's largest cream cheese plants. What took up as an industrial disruption soon forced bakeries across Scandinavia to cut production of their beloved cinnamon buns, which in turn reduced revenues in railway cafés that rely heavily on pastry sales.

A dairy malfunction became a transportation-revenue problem through a sequence no linear model would predict. Cascades expose how systems touch in unexpected places, not to mention how the seemingly whimsical can carry real consequences.

Adaptive Responses as Cascade Fuel

Human reactions can accelerate cascades rather than halt them.

Sri Lanka's 2021 fertilizer ban is a striking example. Because it was introduced abruptly, without transition planning, agricultural yields collapsed. Lost export revenue triggered foreign exchange shortages, which triggered fuel scarcity, which triggered mass protests, which toppled the government.

The cascade was produced not simply by error, but by adaptive responses at each stage that reshaped the crisis: Farmers changed planting decisions, traders changed pricing, citizens changed political behavior.

Cascades in polycrisis contexts are rarely passive. They are co-produced by the systems and actors within them.

Cascades Through Mobility and Flow

Urban systems, defined by movement and density, are especially prone to cascades.

In Seoul in 2022, a few hours of unusually heavy rain overwhelmed storm drains, flooding subway lines. Commuters shifted to ride-hailing services, which clogged roads, delaying emergency response units pressured by the same storm.

A meteorological anomaly became a transportation crisis, then a public safety issue, demonstrating how movement systems amplify disturbances by distributing them socially and spatially.

The Consequence of Cascading

Cascading dynamics transform crises from isolated disruptions into multi-domain challenges.

- They ensure that failures rarely remain local, that interventions must be cross-sectoral, and that understanding any crisis requires tracing how pressures travel across boundaries.
- Cascades make modern crises spatially mobile, temporally unpredictable, and structurally intertwined.
- They are the mechanism through which overlapping systems and nonlinear dynamics produce crisis environments that expand rather than contract.

Temporal Dynamics: Time, Speed, and Rhythm in Polycrisis

The temporal characteristics of polycrisis — and how they unfold over time — create distinctive challenges for sensemaking and response. Simple crises may have clear beginnings, peaks, and endings, polycrises exhibit complex temporal patterns that evolve at multiple time scales.

Multi-Scale Temporal Dynamics

Polycrises operate simultaneously at multiple time scales.

Some components may evolve rapidly over hours or days, while others unfold over months, years, or decades. Climate change operates on time scales of decades and centuries, but it can also trigger extreme weather events that unfold over days and create immediate crises in food systems, infrastructure, and human security.

This temporal complexity creates challenges for both analysis and response. Decision-makers must simultaneously manage immediate crises while addressing slower-moving but fundamental challenges. The urgency of immediate problems often crowds out attention to longer-term issues, but ignoring longer-term dynamics can make immediate problems worse.

Synchronization and Desynchronization

In some polycrises, different crisis components become synchronized, evolving at similar rates and reinforcing each other.

The 2008 financial crisis showed synchronization effects as problems in housing markets, banking systems, and economic confidence all evolved rapidly and reinforced each other.

In other cases, a polycrisis involves desynchronized components that evolve at different rates and may sometimes work against each other. The challenge of coordinating responses across components with different temporal dynamics is one of the distinctive features of polycrisis management.

Memory Effects and Path Dependence

Complex systems often exhibit memory effects where past events influence present behavior and future possibilities. This creates path dependence, where the sequence of events matters as much as the events themselves.

In a polycrisis, memory effects mean that early responses can have long-lasting consequences that constrain future options. Institutional responses developed during crisis periods may persist long after the immediate crisis has passed, shaping how future crises are understood and managed.

Acceleration and Deceleration Phases

Polycrises typically display phases of acceleration when crisis components reinforce each other and system behavior becomes increasingly rapid and unstable, alternating with phases of deceleration when dampening mechanisms become more effective and system behavior stabilizes.

Making sense of these phases is important for crisis management because different interventions are appropriate at different phases. During acceleration phases, the priority may be preventing system collapse and managing immediate impacts. During deceleration phases, there may be opportunities for more fundamental reforms and system building.

A Grammar for the World We Now Inhabit

FONIC is best understood not as a framework to be applied but **as a grammar for interpreting the world** we increasingly find ourselves in.

It describes the underlying structure of contemporary crises:

- The brittleness of systems optimized beyond safety.
- The way pressures stack across domains.
- The unpredictable leaps of nonlinear dynamics.
- The deep interdependence that binds distant sectors together, and the ease with which disturbances travel and transform.

This grammar does not simplify complexity. It makes complexity legible.

Recognizing this pattern is not an academic exercise.

It requires a shift in attention, especially for leaders accustomed to treating crises as discrete, linear problems with clear boundaries.

In a FONIC-shaped environment, action in one domain reverberates unpredictably into others, and attempts to "solve" one part of a crisis may intensify another. Leaders who cling to linear thinking will repeatedly find themselves surprised – not because events are unknowable, but because they are operating with a mental model that no longer matches the behavior of the systems they depend on.

At the same time, FONIC offers no comfort through grand solutions or neat prescriptions.

It describes a world that is structurally intertwined, unevenly governed, and susceptible to sudden shifts. These are not flaws we can simply engineer away. They are features of a global system built for speed, efficiency, and scale. Pretending otherwise is wishful thinking.

The value of FONIC lies in its ability to reveal what is already true: That crises do not arrive as isolated misfortunes but as expressions of deeper systemic conditions.

Yet this realism should not be mistaken for pessimism. Understanding the grammar of the polycrisis does not eliminate uncertainty, but it makes us better navigators of it. Leaders who grasp FONIC's dynamics can detect fragilities earlier, recognize where overlapping pressures are forming, anticipate nonlinear leaps, and trace how cascades might unfold. This does not grant control, but it cultivates judgment – the kind of informed, adaptive decision-making that matters when prediction is impossible and when conditions can shift overnight.

In this sense, FONIC is an invitation to see more clearly. It asks us to move beyond outdated notions of crisis management and toward a more nuanced understanding of how modern systems behave. It is a call for humility, vigilance, and intellectual honesty – qualities that make resilience possible not by simplifying the world, but by teaching us to read it as it truly is.

Implications for Crisis Management

This is how we will need to approach crisis management:

- **Systems Thinking:** The interconnected nature of polycrisis requires approaches that can capture system-level dynamics rather than focusing only on individual components.
- **Adaptive Management:** Uncertainty and complexity require management approaches that can learn and adapt rather than implementing fixed plans.
- **Multi-Scale Coordination:** The temporal complexity of polycrisis requires coordination across different time scales and different organizational levels.
- **Robust Decision-Making:** Non-linearity and uncertainty require decision-making approaches that work well across a range of possible outcomes rather than optimizing for specific scenarios.
- **Anticipatory Governance:** The speed and interconnectedness of modern polycrises require governance systems that can anticipate and prepare for rapid changes rather than only reacting to problems after they occur.

As we will see in subsequent chapters, these characteristics also point toward opportunities for more effective polycrisis management through approaches that work with complexity, that build adaptive capacity, and that create resilient systems.

The characteristics of a polycrisis are the challenges to be overcome, and they are also sources of potential leverage for creating positive change.

The same interconnectedness that allows crises to spread rapidly can also allow solutions to spread rapidly. The same complexity that makes systems unpredictable also creates opportunities for positive emergence and innovation. The same non-linearity that can make small problems become large can also allow small solutions to have large impacts.

In the next chapter, we explore how insights from complexity science can deepen our understanding of these characteristics and point toward new approaches for polycrisis management.

PART 2

On Complex, Adaptive Systems

CHAPTER 4

A NEW LENS FOR UNDERSTANDING CRISES

Complexity Science and the Polycrisis

Traditional approaches to crisis analysis, rooted in linear thinking and reductionist methods, struggle with the emergent properties and dynamic interactions that define polycrises. They assume stable cause-and-effect relationships, identifiable levers, and problems that can be decomposed into parts and solved piece by piece.

Polycrisis does not behave this way.

They involve multiple, overlapping systems, adaptive actors, and feedback loops that make outcomes surprising even when individual components are well understood.

Complexity science offers a fundamentally different way of understanding systems and their behavior. Rather than focusing on parts in isolation, it examines how interactions among components give rise to system-level patterns that cannot be predicted from the parts alone.

Its principles help explain why polycrises behave as they do and point toward new strategies for more effective crisis and innovation responses.

Origins and Evolution of Complexity Science

Complexity science emerged in the latter half of the 20th century as researchers across multiple disciplines confronted phenomena that traditional approaches could not adequately explain. Weather systems exhibited sensitive dependence on initial conditions; ecosystems displayed emergent properties; financial markets behaved in ways that defied equilibrium models. These apparently different systems showed strikingly similar patterns.

Several intellectual currents laid the groundwork:

- **Cybernetics and systems theory (1940s–1950s):** Norbert Wiener's cybernetics and Ludwig von Bertalanffy's general systems theory redirected attention from individual components to feedback, control, and system-level behavior.
- **Chaos theory (1960s–1970s):** Edward Lorenz's work on weather systems and Benoit Mandelbrot's work on fractals revealed how simple rules could generate complex, seemingly unpredictable dynamics.

- **Network theory (1950s–present):** Graph theory evolved into rich approaches for studying how patterns of connectivity shape system behavior, from neural networks to power grids to social media platforms.
- **Complexity economics (1980s–present):** Scholars such as Brian Arthur and Stuart Kauffman applied complexity concepts to economic systems, challenging assumptions of equilibrium and perfectly rational actors.
- **The Santa Fe Institute (from 1984):** The founding of the Santa Fe Institute created an institutional home for cross-disciplinary work on complexity, drawing together physicists, biologists, economists, computer scientists, and social scientists.

Interdisciplinary Integration

What distinguishes complexity science is its inherently interdisciplinary nature.

Researchers found that ant colonies, stock markets, immune systems, and social movements all display similar patterns: adaptation, feedback, path dependence, and emergent order. This led to the development of general principles that apply across very different types of systems.

For understanding a polycrisis, this perspective is particularly valuable.

By definition, polycrises involve interactions across domains that are usually studied separately: economics, ecology, technology, politics, culture. Complexity science provides a shared language and set of concepts that can span these boundaries. It allows us to treat a pandemic, a financial shock, a climate event, and a social uprising not as isolated phenomena, but as interacting processes within a larger complex adaptive system.

Yes, we know this sounds really abstract, but if it helps, you might think of complexity science as the point where an ecologist, a macroeconomist, a data scientist, and a sociologist can look at a meme going viral, a bank run, and a locust swarm and all say, **"Yes, I recognize that pattern."**

Core Concepts in Complexity Science

These core ideas from complexity science are especially relevant for understanding polycrisis behaviors. They offer both analytical tools and practical insights.

Complex Adaptive Systems

A **complex adaptive system (CAS)** consists of many interacting agents that adapt their behavior based on experience and changing conditions. The agents follow relatively simple rules locally, but their interactions generate complex, often surprising patterns at the system level.

Typical characteristics include:

- **Distributed control:** No single authority fully controls system behavior.
- **Connectivity:** Agents are linked through networks of relationships.
- **Co-evolution:** Agents and the system evolve together over time.
- **Sensitive dependence:** Small changes can have large, system-wide effects.

- **Emergent behavior:** System-level properties arise from local interactions.
- **Far from equilibrium:** Systems are constantly changing and adapting rather than settling into a static state.

Polycrisis systems show all these traits.

Crisis responses involve individuals, firms, governments, markets, media platforms, and civil society organizations, each adapting to changing conditions and to one another. No single actor can steer the entire system. Patterns such as panic buying, sudden shifts in trust, or rapid policy swings emerge from their interactions rather than from any one decision.

For instance: During the early COVID-19 pandemic, no one actor decided that supermarket shelves should be emptied of toilet paper. Local, individually rational decisions – "I'll stock up, just in case" – interacted through social networks and media coverage to produce a global pattern of scarcity.

Phase Spaces and Attractors

Phase space is a mathematical concept that represents all possible states of a system. Within this space, some regions are more likely or more stable than others. These regions are known as **attractors** because the system tends to move toward and remain within them.

Different types of attractors correspond to different behaviors:

- **Fixed-point attractors:** The system settles into a stable state.
- **Periodic attractors:** The system oscillates in regular cycles.
- **Strange attractors:** The system exhibits complex, seemingly random behavior that nonetheless follows underlying patterns.

During a polycrisis, systems can shift between attractors.

A relatively stable social order (fixed-point) may move into cycles of protest and repression (periodic), and then tip into chaotic upheaval (strange). Recognizing attractor dynamics helps explain why some interventions shift system behavior meaningfully, while others merely push the system back into its previous patterns.

Thus a social media platform might begin as a space for personal updates and cat photos (one attractor), gradually shift into heated culture war debates (another attractor), and eventually settle into polarization and harassment as its default mode. The underlying code may change little; the attractor the system occupies does not.

Fitness Landscapes

Originally developed in evolutionary biology, **fitness landscapes** offer a metaphor for how systems adapt and evolve. In a fitness landscape, height represents the "fitness" or success of different configurations, and the landscape itself may shift over time.

Systems tend to "move uphill" toward higher fitness, but they can become trapped on **local peaks** that are good enough in the short term but prevent them from reaching better configurations elsewhere. This is as true for business models and institutions as it is for species.

Fitness landscapes help explain why:

- Locally optimal crisis responses may be globally suboptimal.
- Institutions become locked into familiar but fragile modes of operation.
- Effective long-term responses sometimes require accepting short-term losses or uncertainty.

Network Effects and Topology

Network theory studies how the structure of connections between components affects system behavior. Different network topologies — random, scale-free, small-world, modular — produce different patterns of information flow, resource distribution, and crisis propagation.

Key concepts include:

- **Centrality:** Identifying important nodes and connections.
- **Clustering:** The tendency for connected nodes to also be connected to each other.
- **Path length:** The typical distance between two nodes in the network.
- **Robustness:** How well the network maintains function when nodes or links fail.

Network topology is crucial for polycrisis understanding and management, because it determines:

- How quickly crises spread.
- Which actors are key leverage points.
- Where fragmentation can contain problems and where it will simply create new ones.

So, when e.g. a major DNS provider or cloud platform fails, half the internet appears to "vanish" at once. This is not because everything is centrally controlled, but because many services quietly depend on the same few highly central nodes.

Applications for Understanding a Polycrisis

Traditional crisis analysis often assumes simple, linear causality: Event A causes impact B. Complexity science shows that in interconnected systems, crisis propagation is far more intricate. It involves multiple pathways, feedback loops, delays, and emergent effects.

Two families of models are especially useful:

- **Contagion models** from epidemiology and network science explain how disturbances spread through contact networks. Diseases spread through human contact; financial crises spread through interbank exposures; social unrest spreads through communication networks; supply chain disruptions spread through trade and logistics. The same initial shock can have vastly different effects depending on where in the network it begins, how the network is structured, when it hits, and how participants respond.

- **Cascade models** examine how small disruptions trigger large-scale system failures via interconnected dependencies. These models are used to study power grid blackouts, financial collapses, ecosystem regime shifts, and more. They highlight:
    - **Critical nodes:** Components whose failure has disproportionate system impact.
    - **Cascade triggers:** Conditions under which local failures become system-wide.
    - **Circuit breakers:** Mechanisms that can halt cascades before they spread.
    - **Recovery dynamics:** How systems rebuild, and what new vulnerabilities emerge in the process.

Consider the 2021 blockage of the Suez Canal by a single container ship, the *Ever Given*.

A sudden wind caused the ship to touch bottom, veering it so that it blocked the narrow channel, which temporarily froze roughly 12% of global trade.

One misaligned vessel became a global shipping and manufacturing incident, illustrating both contagion (delays spreading through schedules) and cascades (factories idling for lack of parts).

Analyzing System Resilience

Complexity science offers a nuanced view of resilience. The ability of systems to maintain function in the face of disturbance and to adapt or transform when necessary. It distinguishes several forms:

- **Engineering resilience:** The speed and capacity with which a system returns to its previous state after a shock.
- **Ecological resilience:** The capacity to absorb disturbances while retaining key functions and structures, even if the precise state changes.
- **Social-ecological resilience:** The ability of linked human–environment systems to adapt and transform in response to changing conditions.

For a polycrisis, social-ecological resilience is often most relevant. It recognizes that returning to a previous state may be neither possible nor desirable. In many cases, effective response requires transformation: changing institutions, norms, infrastructures, and expectations rather than simply “bouncing back.”

Identifying Leverage Points

Complexity science also helps identify **leverage points**, places in a system where small, well-designed interventions can produce significant change.

Donella Meadows proposed a hierarchy of leverage points, from least to most powerful:

1. **Constants, numbers, and subsidies** (e.g., tax rates, quotas).
2. **Material stocks and flows** (e.g., infrastructure, supply chains).
3. **Negative feedback loops** (e.g., stabilizing regulations).
4. **Positive feedback loops** (e.g., incentives that reinforce change).
5. **Information flows** (who knows what, when).

6. **Rules of the system** (incentives, constraints, property rights).
7. **Power to change system structure** (who gets to change the rules).
8. **Goals of the system** (what the system is trying to achieve).
9. **Mindset or paradigm** (the underlying ideas and assumptions that create the system).

The most effective interventions tend to act at the higher levels: changing goals, rules, power, and paradigms. This helps explain why purely technical fixes to polycrises often disappoint. They adjust parameters within existing structures rather than altering the structures that generate the crises in the first place.

Analytical Tools from Complexity Science

Complexity science has developed a range of analytical tools useful for visualizing, simulating, and testing interventions in a polycrisis context.

Agent-Based Modeling

Agent-based models (ABMs) simulate the behavior of individual agents and observe the system-level patterns that emerge from their interactions. ABMs are particularly valuable because they can incorporate:

- **Heterogeneous agents:** Different types of actors with different characteristics and decision rules.
- **Local interactions:** Agents respond to neighbors and local conditions, not just global averages.
- **Adaptive behavior:** Agents change their actions based on experience and feedback.
- **Emergent properties:** System-level behaviors arise without being programmed explicitly.
- **Scenario testing:** Different initial conditions or policies can be explored without real-world risk.

ABMs have been used to study traffic flows, market dynamics, epidemic spread, innovation diffusion, and social movement dynamics.

For a polycrisis analysis, they can illuminate how individual and organizational responses combine to create unexpected system-level outcomes. ABMs have even been used to simulate fictional zombie outbreaks as a way to teach students about contagion, evacuation behavior, and infrastructure strain – a playful example that nonetheless reveals serious lessons about real crises.

Network Analysis

Network analysis provides tools for understanding both the structure and dynamics of interconnected systems:

- **Centrality analysis** identifies key nodes using measures such as:
    - Degree centrality (number of connections).
    - Betweenness centrality (position on shortest paths).
    - Closeness centrality (average distance to all others).
    - Eigenvector centrality (connections to other important nodes).

- **Community detection** reveals clusters of nodes more densely connected to each other than to the rest of the network, often corresponding to functional communities or sub-systems.
- **Dynamical analysis** tracks how networks evolve over time: connections forming or dissolving, hubs emerging or disappearing.
- **Vulnerability analysis** examines how different failure patterns affect overall robustness, such as random failures versus targeted attacks on hubs.

For polycrises, network analysis helps identify where a crisis is likely to spread, who is most exposed, and where interventions will have the greatest impact.

System Dynamics Modeling

System dynamics focuses on feedback loops, time delays, and accumulations that drive system behavior over time.

Key elements include:

- **Stock and flow diagrams:** Visual representations of accumulations (stocks) such as population, capital, or trust, and the rates of change (flows) that increase or decrease them.
- **Causal loop diagrams:** Maps of reinforcing and balancing feedback loops, showing how changes in one variable propagate through the system.
- **Simulation models:** Computational implementations that allow users to test how different policies or shocks play out over time.

System dynamics has been applied to urban growth, business cycles, public health, and environmental change. In polycrisis analyses, it is particularly useful for revealing how delayed feedback, unintended consequences, and reinforcing loops can amplify or dampen crisis dynamics.

Implications for Polycrisis Management

The insights from complexity science have profound implications for how we approach polycrisis management. Rather than attempting to fight complexity or simplify it away, we need approaches that work with complex system dynamics.

Design for Emergence

Traditional management often aims to control outcomes through detailed planning and hierarchical coordination. In complex systems, this frequently fails. Emergent behavior and adaptive responses will outpace any fixed plan.

A complexity-informed approach focuses on **creating conditions** that foster positive emergence:

- Setting **simple rules** that guide behavior without overconstraining it.
- Building **platforms** that enable productive interactions among diverse actors.
- Providing **flexible resources** that can be repurposed as opportunities arise.
- Removing **barriers to adaptation**, such as rigid procedures or siloed information.

Build Adaptive Capacity

Because complex systems are inherently unpredictable, effective management emphasizes **adaptive capacity** rather than exhaustive prediction and prevention.

Adaptive capacity includes:

- **Diversity:** Multiple approaches and perspectives, offering options under different conditions.
- **Redundancy:** Backup systems and capabilities that maintain function when primary systems fail.
- **Modularity:** Organizational designs that contain failures within subsystems rather than allowing them to spread unchecked.
- **Learning capability:** Mechanisms for detecting change, experimenting with responses, and embedding lessons into practice.

Work with Network Effects

Network structure shapes both risks and opportunities. Complexity-informed strategies:

- Identify **key nodes** (actors, institutions, platforms) whose influence extends widely.
- **Strengthen beneficial connections** that support coordination, learning, and resilience.
- **Manage or rewire harmful connections** that enable rapid crisis propagation or lock in destructive behaviors.
- **Create new links** where isolation or fragmentation undermines effective response.

Embrace Experimentation

In complex systems, it is impossible to know in advance which interventions will succeed. This creates a strong case for structured experimentation:

- **Portfolio approaches:** Testing multiple interventions in parallel instead of relying on a single grand solution.
- **Rapid prototyping:** Implementing and iterating on interventions quickly rather than waiting for perfect designs.
- **Learning systems:** Capturing, sharing, and acting on lessons from successes and failures.
- **Scaling strategies:** Expanding successful experiments while adapting them to local contexts.

Sometimes a crisis is just what you need!

Cities experimenting with temporary "pop-up" bike lanes and pedestrian zones during the pandemic discovered, in real time, which changes improved mobility and local business – turning crisis improvisation into long-term urban design shifts.

The Path Forward

Complexity science does not replace other forms of knowledge, but it complements them by making visible the patterns and dynamics that define polycrisis environments.

It offers a way to see how crises actually behave in the wild, rather than how we might prefer them to behave in our models and institutions. As our world becomes more interconnected, faster-moving, and structurally intricate, these insights become less optional and more foundational.

The FONIC framework (and if you've already forgotten, that stands for Fragile, Overlapping, Nonlinear, Interconnected, Cascading) can be read as a shorthand for what complexity science keeps revealing.

Complexity tools help us understand **fragility** through concepts like fitness landscapes, network vulnerabilities, and lock-in on local peaks. They illuminate **overlapping** systems through multi-layer networks and system-of-systems analysis. They formalize **nonlinearity** in attractors, tipping points, power laws, and feedback loops. They map **interconnectedness** through network topology and contagion models, and they describe **cascading** with simulations of how failures propagate across infrastructures, markets, and social systems.

Complexity science provides the analytical depth. FONIC provides a concise vocabulary for the recurring pattern.

Practically, this means that complexity science and FONIC together offer not a recipe, but an orientation.

They nudge us to ask different questions:

- Where are we most fragile, and where have we traded redundancy for efficiency?
- Which systems are overlapping in ways we do not fully see?
- Where might nonlinear shifts occur, and what early signals would warn us?
- How exactly are we interconnected – through which networks, dependencies, and chokepoints?
- And if a disturbance does occur, along which pathways is it likely to cascade?

These questions do not simplify the world, but they help us navigate it more intentionally.

The task, then, is not to eliminate complexity, but to become more skillful in living with it: to recognize fragility before it fails, to work more consciously with overlapping systems, to respect nonlinearity rather than assume proportionality, to map and, where necessary, redesign our interconnections, and to anticipate and redirect cascades instead of being surprised by them.

Approached in this way, complexity science is no longer an abstract theory and FONIC is no longer just a neat acronym. Together, they become a practical grammar for sense-making and a guide for designing institutions, infrastructures, and responses that are better suited to a turbulent century.

CHAPTER 5

THE EMERGENCE OF A POLYCRISIS

What Emergence Is

Among the many concepts complexity science offers for understanding polycrisis, **emergence** is perhaps the most fundamental.

It explains:

- Why polycrises exhibit behaviors and properties that cannot be predicted from understanding their individual components.
- Why solutions that work for individual crisis elements may fail at the system level.
- Why entirely new challenges and opportunities arise from interactions between crisis components.

Emergence challenges a basic assumption of traditional science and management: that if we understand the parts, we understand the whole.

In emergent systems, the whole is not just greater than the sum of its parts; it is qualitatively different.

This chapter explores how emergence manifests in polycrisis systems, how emergent properties arise and evolve, and how an understanding of emergence can inform more effective approaches to polycrisis management. Emergence is not just an elegant theoretical idea. It is a practical reality that must be understood, worked with, and sometimes deliberately cultivated, rather than ignored or resisted.

Emergence: From Simple Interactions to Complex Properties

Emergence refers to phenomena where systems display properties, behaviors, or patterns that arise from interactions among components but **cannot be reduced to, or predicted from, those components in isolation**. These emergent properties exist only at the system level and constitute genuinely new features of reality. For instance, no single ant "knows" how to build an anthill, yet anthills get built. No single user designs a social media pile-on, yet somehow a hashtag turns into a global backlash by nightfall.

Strong vs. Weak Emergence

Philosophers and scientists distinguish two broad forms:

- **Weak emergence:** System-level properties arise from local interactions in ways that are *theoretically* predictable but practically intractable without simulation.
    - *Example:* A flock of birds. Each bird follows simple rules (stay close, avoid collisions, align with neighbors), but the swirling, coordinated flock behavior is difficult to predict without modeling.

- **Strong emergence:** System-level properties are genuinely novel and, in principle, cannot be reduced to or derived from lower-level properties.
    - *Example:* Consciousness emerging from neural activity is often cited here, though whether strong emergence really exists remains contested.

For polycrisis management, the philosophical distinction matters less than the operational lesson: in both cases, system-level properties demand analysis and response **at the system level**, not just at the level of individual components.

Synchronic vs. Diachronic Emergence

Another useful distinction concerns **when** emergent properties arise:

- **Synchronic emergence** refers to properties that exist at a particular moment due to the current configuration of components.
    - *Example:* Traffic patterns in a city at rush hour. They arise from the positions and movements of individual vehicles but are properties of the traffic system as a whole.

- **Diachronic emergence** refers to properties that arise over time through historical development.
    - *Examples:* Cultural norms, institutional routines, and technological ecosystems. These emerge from repeated interactions, learning, and path dependence; they make little sense without history.

Polycrises exhibit both.

Immediate crisis responses can generate **synchronic emergent patterns** (e.g., panic buying or spontaneous mutual aid), while longer-term adaptations produce **diachronic emergent changes** that reshape economies, institutions, and social relations.

Mechanisms of Emergence in Complex Systems

Making sense of emergence in polycrisis requires looking closely at how local interactions give rise to system-level properties. Several mechanisms are particularly important.

Self-Organization and Pattern Formation

Self-organization occurs when components spontaneously form ordered patterns or structures without central control. Local interactions governed by simple rules produce global order.

Examples abound:

- **In nature:** sand dunes from wind and particles; cells organizing into tissues via chemical signaling; ecosystems structuring themselves through species interactions.
- **In social systems:** markets arising from individual trading decisions; social movements forming from many personal choices; communities emerging from patterns of association and reciprocity.

In polycrisis contexts, self-organization can be:

- **Beneficial**, as in:
    - Spontaneous mutual aid networks during disasters.
    - Distributed problem-solving that generates innovative responses.
    - New collaborations across institutional and sectoral boundaries.

- **Harmful**, as in:
    - Panic behaviors that amplify scarcity and stress.
    - Hoarding dynamics that create or worsen shortages.
    - Misinformation or conspiracy networks that erode trust and undermine coordinated response.

No one in traditional finance scheduled “Meme Stock Week.”

A few sarcastic posts on a Reddit forum, some screenshots of short positions, and a handful of small traders piling into GameStop and AMC shares turned into a global spectacle that briefly wiped billions off hedge funds. That wasn’t a coordinated campaign so much as self-organization in the wild: thousands of loosely connected actors following local rules (cheap trades, shared jokes, a dash of resentment) generating a market event no regulator or bank had on its calendar.

Network Effects and Collective Behavior

Network structure shapes how emergence unfolds. The same components can produce very different system behaviors depending on how they are connected.

Different network types matter:

- **Small-world networks:** High local clustering plus occasional long-distance links.
    - Enable local coordination *and* rapid system-wide spread.
    - Great for sharing innovations, equally great for spreading contagion.

- **Scale-free networks:** A few highly connected hubs, many low-degree nodes.
    - Robust to random failures (most nodes are peripheral).
    - Vulnerable to targeted attacks on hubs (remove a few key nodes, and the system fragments).

- **Random networks:** More uniform connectivity.
  - More robust against targeted attacks.
  - Often less efficient for coordination and can be more vulnerable to widespread random failures.

For polycrisis, network effects help explain why seemingly similar crises behave very differently across contexts: who is connected to whom, and through what channels, matters at least as much as the crisis "content" itself.

Feedback Loops and Dynamic Interactions

Emergence often arises from **feedback loops**, where outputs feed back into inputs.

- **Positive (reinforcing) feedback** amplifies change.
  - Economic bubbles: rising prices → more optimism → more investment → further price rises.
  - Social movements: visible participation → sense of momentum → more people joining.

- **Negative (balancing) feedback** stabilizes systems.
  - Price signals: higher prices reduce demand, stabilizing markets.
  - Social norms: sanctions and approval maintain behavioral regularities.

Complex systems typically contain many interacting loops. Their interplay generates dynamics such as:

- Oscillations (booms and busts).
- Regime shifts (sudden transitions to new patterns).
- Chaotic behavior (apparently random, but structured by underlying rules).

Viewed in isolation, each loop seems understandable; their combined behavior is often anything but.

Phase Transitions and Critical Phenomena

Many emergent properties arise through **phase transitions**: abrupt qualitative changes in system behavior when parameters cross critical thresholds.

Physical examples are familiar: water freezing or boiling; magnetism appearing below a critical temperature. Social and institutional analogues include:

- Protests that build slowly, then suddenly cascade into a revolution.
- Traffic that flows smoothly until density passes a threshold and jams appear.
- Institutions that appear robust until legitimacy drops below a point, after which collapse accelerates.

Phase transitions often exhibit:

- **Critical slowing down:** Systems respond more slowly as they approach critical points.
- **Increased variability:** Fluctuations become larger and more frequent.
- **Growing correlations:** Local disturbances become coupled across greater distances.
- **Power-law behavior:** Extreme events become more likely relative to "normal" conditions.

Phase-transition dynamics help identify when systems are nearing critical thresholds – and when small interventions could trigger disproportionately large changes.

Emergence in Polycrisis: Examples and Case Studies

Polycrises are, in many ways, laboratories of emergence.

They show how interacting crises generate novel patterns that cannot be inferred from any one crisis in isolation.

COVID-19 as a Laboratory of Emergence

The COVID-19 pandemic began as a health emergency but rapidly became a polycrisis, generating emergent properties across work, education, social life, and economics.

Key emergent patterns included:

- **Emergent work patterns:**
  The large-scale shift to remote work was not the product of a single grand plan but of countless local adaptations to health restrictions and digital affordances. Over time, this reshaped urban–rural dynamics, office real-estate markets, and organizational cultures.

- **Emergent educational innovation:**
  School closures forced rapid experimentation with remote learning. New hybrids of classroom instruction, online platforms, parental involvement, and student self-management emerged, many of which persisted beyond the immediate crisis.

- **Emergent solidarity and division:**
  Mutual aid networks, neighborhood support, and shared rituals displayed emergent solidarity. At the same time, conflicts over masks, vaccines, and restrictions produced emergent polarization. These patterns arose from interactions among health risks, media ecosystems, economic stress, and institutional trust.

- **Emergent economic transformation:**
  Contactless commerce, acceleration of digitalization, restructuring of supply chains, and shifts in urban density were not simply "responses" but emergent transformations created as businesses, consumers, and regulators adapted under pressure.

Sourdough starters becoming global status symbols was not on any government's pandemic preparedness checklist, yet there we were – a small emergent symbol of people reconfiguring daily life under constraint.

Climate Change and Cascading Emergence

Climate change provides examples of emergence across spatial and temporal scales:

- **Emergent extreme weather patterns:**
  Climate change alters not just averages but the structure of weather systems, contributing to phenomena such as atmospheric rivers, polar vortex disruptions, and compound events that combine heat, drought, and fire in ways not captured by historical experience.

- **Emergent migration patterns:**
  Environmental stress interacts with inequality, governance, and social networks to produce new migration flows. These are not simple "climate refugees" following temperature gradients, but complex movements shaped by politics, opportunity, and risk.

- **Emergent adaptation innovations:**
  Communities blend traditional knowledge and new technology to devise context-specific adaptation strategies. Over time, these local innovations can aggregate into systemic shifts in agriculture, water management, and urban design.

Financial Systems and Emergent Crisis

Financial systems are classic examples of emergent order and emergent instability:

- **Emergent market functions:**
  Price discovery, liquidity, and risk allocation emerge from countless individual trades. No single trader manages the "market," yet the market exhibits recognizable system-level properties.

- **Emergent systemic risk:**
  The 2008 financial crisis showed how systemic risk can emerge from individually rational behavior. "Too big to fail" institutions, opaque derivatives, and correlated exposures created vulnerabilities that were invisible when looking only at individual balance sheets.

- **Emergent regulatory responses:**
  New regulatory tools — macroprudential oversight, stress testing, international coordination — emerged from interactions among policymakers, markets, and public pressure. These institutional innovations were not predesigned; they evolved in response to crisis.

Working with Emergence

Grasping emergence is not just intellectually satisfying; it has direct implications for how we organize and implement crisis response. Effective polycrisis management learns to **recognize, support, and gently steer** emergent processes rather than trying to override them.

Early Detection of Emergent Properties

Recognizing emergence early requires new forms of situational awareness that focus on system-level patterns, not just isolated indicators.

Key capabilities include:

- **Pattern recognition:** Spotting subtle shifts in behavior, correlations, or variability that suggest new system properties are forming.
- **Multi-scale monitoring:** Observing dynamics at individual, organizational, community, national, and global levels — and seeing how they interact.
- **Cross-domain integration:** Connecting signals from health, economics, politics, technology, and ecology rather than treating them as separate streams.
- **Historical comparison:** Using analogues from past crises to recognize familiar emergent patterns in new guises.
- **Weak-signal detection:** Taking small, strange signals seriously — not as definitive forecasts, but as early hints of potential emergence.

A sudden spike in Google searches for "how to break a lease", a burst of new mutual aid groups on social media, and a wave of small business closure notices may, together, signal an emergent urban exodus long before official statistics catch up.

Implications for Polycrisis Strategy

Taking emergence seriously changes how we think about strategy.

Emergence-informed approaches focus less on imposing solutions and more on **shaping conditions for beneficial system-level change**.

Three shifts are particularly important:

1. From Problem-Solving to System Transformation

Traditional crisis management aims to fix discrete problems and restore previous states. Emergence-informed approaches recognize that in polycrises, "going back" is often impossible or undesirable. The goal shifts to:

- Focusing on overall system health rather than eliminating single symptoms.
- Building transformative capacity, not just immediate fixes.
- Working with system evolution rather than defending static stability.
- Supporting emergent positive adaptations instead of prescribing all outcomes.

2. From Planning to Sensing and Responding

Rather than relying primarily on detailed plans based on current models, emergence-informed strategies emphasize:

- Investing in sensing systems that can detect emergent patterns early.
- Building rapid, flexible response capabilities that can be mobilized as conditions evolve.
- Developing learning architectures that incorporate lessons from emergent experiences into practice.
- Creating institutions that are capable of revising their own structures and rules when reality changes.

3. From Control to Influence

In emergent systems, attempts at tight control are often counterproductive. The focus shifts toward:

- Understanding system dynamics rather than dictating specific trajectories.
- Shaping **enabling conditions** (incentives, information flows, norms) rather than micromanaging actions.
- Facilitating connections and collaborations rather than centrally coordinating every interaction.
- Providing resources, flexibility, and support in ways that allow constructive emergent behaviors to scale.

In the next chapter, we turn to **self-organization** to explain how order, coordination, and sometimes chaos can arise spontaneously in crisis situations without central planning or control – and how that can be both a risk and a resource in navigating the polycrisis.

CHAPTER 6

ORDER WITHOUT ORDERS

Spontaneous Order in Complex Systems

While emergence explains how new properties arise from system interactions, **self-organization** explains how complex systems can create and maintain order without central control.

It challenges one of our most deeply rooted assumptions about social and organizational life: that organization requires organizers.

In polycrisis situations, self-organization becomes critically important. Traditional organizing mechanisms such as hierarchies, formal coordination systems, and established procedures are often overwhelmed, disrupted, or simply too slow.

Yet, in precisely these periods, we see striking examples of spontaneous order: communities mobilizing disaster response without official coordination, innovations emerging through distributed problem-solving, and new forms of cooperation crossing institutional and sectoral boundaries.

Self-organization offers insight into how beneficial order can arise during polycrises, how to create conditions that support positive self-organization, and how to work with self-organizing processes rather than against them.

What Self-Organization Is

Self-organization is the process by which components of a system spontaneously arrange themselves into ordered patterns or structures **without external direction**.

Order emerges from local interactions among components that follow simple rules; the resulting structures exist at the system level and cannot be reduced to the properties of any single component.

Several characteristics typically appear together:

- The organization is **spontaneous** rather than centrally designed, even if external conditions influence it.
- It arises from **local interactions** rather than global oversight; components respond to their immediate environment without any grasp of the overall pattern.
- It is driven by **simple rules**, whose repeated application generates complex outcomes.

- It produces **patterns** at scales larger than any individual component, whether spatial (like city layouts), temporal (like rhythms and cycles), or functional (like division of labor).
- It is **adaptive**, reshaping patterns and structures as conditions change, while preserving core organizational properties.
- Control is **distributed** across the system, emerging from interaction rather than hierarchy.

Historical and Natural Examples

Self-organization is not rare or exotic. It is everywhere.

- In **physical systems**, convection cells in heated fluids, crystal formation, and storm systems all exhibit self-organization. Simple physical rules generate complex, large-scale order without a "conductor."
- In **biological systems**, flocking birds, schooling fish, and neural networks in developing brains all self-organize. Ant colonies exemplify this: no ant has the blueprint for the nest, yet complex architectures and labor divisions arise from simple, local interaction rules.
- In **economic systems**, markets exhibit self-organizing behavior through mechanisms Adam Smith encapsulated as the "invisible hand." Individual decisions about buying and selling yield system-level outcomes such as prices, liquidity, and resource allocation, even when no central planner exists.
- In **social systems**, language evolution, social norms, and community formation are all examples of self-organization. No committee designed English grammar, yet it standardizes enough to be usable; no central authority decides how neighborhoods "feel," yet distinct local cultures emerge from everyday interactions.

Consider: Where did jackets-and-jeans come from?

Nobody convened a global task force to invent "business casual." Yet, over a few decades, offices across continents converged on a loosely shared aesthetic that lives somewhere between "court appearance" and "airport lounge." That's self-organization: countless local decisions congealing into a dress code without a single official decree.

Mechanisms of Self-Organization

Self-organization works through a set of mechanisms that transform local interactions into system-level order. Perceiving these helps us see where and how to support constructive self-organization in polycrisis settings.

Feedback Loops

Feedback loops are central here. They connect local actions to system patterns and back again, and can both increase the power of a signal or tame it.

- **Positive (reinforcing) feedback** amplifies successful or salient patterns. In ant colonies, ants that find food leave pheromone trails; other ants follow them, reinforcing the trail and making it more likely to be used again. In social systems, effective innovations spread through imitation, word of mouth, and demonstration effects, creating cycles of adoption.

- **Negative (balancing) feedback** prevents any one pattern from overwhelming the system, providing stability. Predator–prey relationships create balancing feedback that prevents a single species from dominating. In markets, price mechanisms typically act as balancing feedback, moderating extreme shortages or gluts.

In self-organizing systems, it is the **interaction** of reinforcing and balancing feedback that creates dynamic equilibria: forms of order that persist while constantly adjusting.

Nonlinear Interactions and Thresholds

Self-organization is inherently **nonlinear**.

Small changes can sometimes trigger large reorganizations, while large efforts may leave systems relatively unchanged. Several nonlinear phenomena recur:

- **Critical mass effects**, where nothing much happens until a threshold is reached. Social movements often grow slowly and then suddenly surge once participation crosses a visibility or legitimacy threshold.
- **Cascade effects**, where changes in one area trigger rearrangements elsewhere. Financial markets famously show cascades when modest price movements trigger waves of selling or buying, reshaping market structure in hours.
- **Phase transitions**, where systems flip from one mode of organization to another. Traffic flow transitions from smooth movement to congestion once vehicle density passes a critical point; small additional inputs dramatically change the overall pattern.

Diversity and Specialization

Self-organization frequently produces **diversity and specialization** as components adapt to different roles and niches.

Functional differentiation appears when cells in an organism specialize into tissues, or when individuals in a society develop particular skills and occupations. Spatial organization emerges when activities cluster in certain districts of a city – financial centers, entertainment zones, logistics hubs – not because someone drew a perfect map, but because local interactions and incentives made it convenient.

Temporal organization arises when activities synchronize in time. Circadian rhythms in biology, or cultural rituals and weekly patterns in social life, are forms of self-organized temporal structure.

For instance: No single planner decided that mornings are for coffee, emails, and low-grade existential dread, and afternoons are for meetings that should have been emails. Yet across countless organizations, the day self-organizes into a recognizable rhythm.

Self-Organization in Crisis Response

Polycrises are fertile ground for self-organization. Formal structures are stressed or failing, but the need for coordination is high. Under these conditions, local initiative and distributed intelligence often step in.

Hurricane Katrina: Failure from the Top, Order from Below

The 2005 Hurricane Katrina response revealed both the breakdown of formal organization and the potential of self-organization. Official emergency responses failed in well-documented ways: delayed decisions, poor coordination, and mismatched resources.

At the same time, residents, volunteers, and informal groups self-organized rescue operations, supply distribution, and mutual aid. People with boats formed ad hoc "flotillas" to evacuate neighbors. Churches, community centers, and grassroots groups became hubs for food, medicine, and information. Leadership emerged based on local knowledge and competence rather than formal authority.

These self-organized efforts were often faster, more adaptive, and more trusted than official responses. They illustrate how, when formal hierarchies falter, local networks can reassemble basic order from below.

Japan 2011: Orderly Resilience

The 2011 Tōhoku earthquake and tsunami in Japan provided another rich example of self-organization at multiple scales.

Locally, communities organized immediate response activities: evacuations, first aid, improvised shelters, and local resource sharing. Social norms of consideration and mutual responsibility helped produce remarkably orderly behavior despite catastrophic disruption.

Digitally, social media and online platforms enabled self-organized information sharing, volunteer coordination, and resource matching far beyond affected areas. People created their own maps of open shops, fuel availability, medical facilities, and shelter locations, often updating information faster than official systems.

Under conditions of severe constraint, people also invented small but significant adaptations: new ways to conserve energy, share food, and rearrange living spaces. None of these were centrally directed, but together they formed a fabric of self-organized resilience.

Just consider the following: In the weeks after the earthquake, Japanese social media coined and circulated tips such as "set your rice cooker to run at night, not during peak hours," turning millions of individual micro-choices into a self-organized, nationwide demand-smoothing strategy for an overstressed grid.

The Future of Self-Organization in a FONIC World

In a FONIC environment — **Fragile, Overlapping, Nonlinear, Interconnected, Cascading** — the importance of self-organization is likely to increase rather than diminish.

Two trajectories drive this.

1. **Digital technologies** dramatically expand the scale and speed at which self-organization can occur. Cheap communication, global platforms, and low-friction tools for collaboration make

it far easier for people to coordinate without formal institutions. Volunteer crisis maps built in hours, instant crowdfunding for relief efforts, and distributed open-source projects are all examples of digitally amplified self-organization.

2. **Global challenges** such as climate change and pandemics demand coordination at scales and speeds that traditional hierarchical institutions struggle to match. Formal structures remain essential, but they are no longer sufficient on their own.

New technological affordances further shape this landscape:

- **AI systems** can, in principle, support self-organization by providing situational awareness, pattern detection, and decision support while leaving local actors in control of action.
- **Blockchain and decentralized governance** experiments explore how economic and social activities can be coordinated through protocol and code rather than centralized intermediaries.
- **Transnational digital communities** sometimes self-organize faster and more effectively around an issue than formal international institutions.

The critical question is not whether self-organization will occur (it will) but how we design environments in which **constructive** self-organization is more likely than destructive forms. In polycrisis conditions, this means:

- Creating open, reliable information environments that reduce the incentive for misinformation networks to self-organize.
- Supporting local capacity and autonomy so communities can self-organize effectively when formal systems are strained.
- Building platforms, norms, and infrastructures that enable emergent cooperation across boundaries rather than locking actors into brittle hierarchies.

In the next chapter, we turn from theory to practice, examining how the concepts of interconnectedness, complexity, emergence, and self-organization manifest in concrete situations – and what they can teach us about designing more humane and resilient responses to the polycrisis.

PART 3

Simulating the Polycrisis

CHAPTER 7

THE MIMETIC FOUNDATION OF SIMULATION

Simulation as Mimicry in a Polycrisis World

At its core, simulation rests on a simple idea: mimicry.

A model behaves in ways that imitate some salient aspect of the system or concept we care about. The value of the model lies not in copying every detail of reality, but in reproducing the right details for the right purpose.

A flight simulator, for instance, does not recreate every bolt, cable, and hydraulic line in an aircraft. Instead, it captures the dynamics that matter for pilots: how the plane responds to controls, how lift and drag behave under different conditions, how turbulence or engine failure feels and unfolds. The simulator succeeds through **selective fidelity**, focusing on what matters for learning and decision-making.

This selective mimicry becomes even more crucial in futures research and polycrisis analysis. We are not only modeling existing systems; we are:

- Trying to capture the behavioral patterns of systems that do not yet exist, and
- Exploring how current systems might evolve under different conditions.

The effectiveness of simulation hinges on how well we choose what to represent and what to leave out. In the context of polycrisis, the ultimate goal is not prediction but **better decisions**.

Simulation and systems approaches provide technological, linguistic, and cognitive resources for navigating complex, interconnected challenges.

They give us a shared starting point for collective action, strategic intervention, and, ultimately, transformative leadership in a FONIC world.

The Laboratory of Possibilities

Once a model is built that captures essential system behaviors, it stops being a mirror and becomes a laboratory.

We gain the ability to manipulate variables, test hypotheses, and explore scenarios that would be impossible, unethical, or ruinously expensive to try in the real world.

In a polycrisis context, this experimental space becomes particularly powerful. We can stress-test our assumptions and systems:

- What if climate change accelerates beyond mainstream projections?
- How might societies react to widespread technological unemployment?
- What happens if breakthrough technologies arrive faster than institutions can adapt?

Simulation walkthroughs, especially when annotated and explained step by step, can guide stakeholders through complex causal chains and possible outcomes. They become platforms for leadership and dialogue rather than just technical exercises.

Used well, simulation is not something experts do *to* everyone else. It is something they do **with** others. In facilitated sessions, models become shared thinking spaces where government, industry, academia, and civil society can:

- Build a shared understanding of interconnected risks and opportunities.
- Surface conflicting priorities and explore trade-offs.
- Make decision processes more transparent and inclusive.

In many climate-policy simulations, participants "play" different roles – cities, firms, ministries, citizens. As they adjust policies and strategies, the model shows how emissions, inequality, and trust respond over decades. The point is less to get the "right" answer and more to watch how different choices interact and which unintended consequences appear.

Tomorrow's Artifacts

Futures research routinely deals with **artifacts that do not yet exist**: objects, systems, or institutions that may emerge from current trends. These future artifacts become focal points for simulation, allowing us to explore not just abstract scenarios, but concrete manifestations of possible futures.

Consider autonomous vehicle networks in smart cities. The building blocks – self-driving cars, smart traffic systems, sensor-rich streets – exist in prototype form, but their full integration does not. Simulation allows us to ask:

- How might traffic patterns and congestion change?
- What forms of urban planning and zoning might become necessary or obsolete?
- How could such systems fail, and what would those failures look like?

Similarly, a simulation of a future energy grid that includes fusion power, advanced storage, and AI-driven distribution can reveal bottlenecks, vulnerabilities, or unintended consequences invisible when each technology is considered alone.

These future artifacts also function as **boundary objects**: shared points of reference that mean different things to different stakeholders, yet allow them to collaborate. Engineers focus on technical feasibility, economists on costs and incentives, sociologists on behavior and equity, policymakers on governance and risk. The artifact – a simulated grid, transport system, or health ecosystem – becomes a common canvas for interdisciplinary conversation and leadership.

The Power of the Incomplete

Paradoxically, in futures work **incomplete simulations are often more useful** than polished, "finished" models.

Their incompleteness is not a defect; it is a design choice.

Unfinished artifacts acknowledge that our grasp of future systems is partial and evolving. Instead of pretending to have precision we do not have, they leave room for interpretation, adaptation, and contestation. This is especially valuable when dealing with emergent technologies or social shifts where the final form is profoundly uncertain.

Take future work arrangements in a post-pandemic world. A rigid model might try to specify exact percentages of remote versus on-site work. A more useful simulation might instead explore **tensions** – between collaboration and focus, productivity metrics and wellbeing, employee preferences and real estate costs – without fixing a single outcome. Different organizations can then use the same model to explore how those tensions might play out in their own context.

Incomplete simulations also support **iterative learning**. As new data arrives or assumptions prove flawed, models can be adjusted, extended, or partially rewritten. In a rapidly changing environment, the ability to revise is a form of resilience. Further, because incomplete artifacts obviously have "gaps," they invite **participation and co-creation**. Stakeholders can help fill in missing pieces, reinterpret dynamics, or add new scenarios. That process doesn't just improve the model; it builds shared understanding and buy-in among the people who will have to live with the futures being explored.

Agent-Based Futures

Agent-based modeling is one of the most powerful approaches for future-oriented simulation in complex systems. It focuses on individual agents – people, organizations, devices, or other entities – and lets system-level patterns emerge from their interactions.

This bottom-up approach is particularly valuable in domains where human behavior is central and messy. Traditional models often retreat to simplified assumptions about rational behavior or average responses. Agent-based models can represent heterogeneity, learning, imitation, bias, and adaptation much more realistically.

Imagine modeling the adoption of a new technology. An agent-based model might treat each person or organization as an agent with different risk tolerances, social networks, constraints, and information sources. Adoption patterns then emerge from millions of micro-decisions. You see:

- Clusters of early adopters tied together by dense networks.
- Regions of resistance or delay where trust or resources are low.
- Network effects where uptake suddenly accelerates after a critical mass is reached.

The same logic applies to systemic transformations. As agents adapt to changing conditions, their collective behavior creates new conditions that require further adaptation. This recursive loop can generate tipping points, phase transitions, and emergent phenomena that top-down models struggle to capture.

Agent-based approaches also excel at examining **inequality and distributional effects**. Different groups can be modeled with different resources, vulnerabilities, and opportunities, making it possible to explore how "the same" future plays out very differently for different populations. For instance, an agent-based model of a heatwave might show that wealthier agents simply buy more cooling, while poorer agents cluster in a handful of public spaces or endure dangerous temperatures at home. The overall mortality rate might look acceptable in aggregate, even as specific neighborhoods face catastrophic risk.

The Architecture of Change: System Dynamics

Where agent-based models start from individuals, **system dynamics** models start from structure. They focus on feedback loops, delays, and the stocks and flows that shape system behavior over time. Agent-based models help us see *who* is doing what; system dynamics shows us how the system pushes back.

Stocks might include population, capital, emissions, trust, or hospital capacity. Flows represent processes that increase or decrease these stocks. Feedback loops link them: reinforcing loops accelerate growth or decline, balancing loops stabilize or resist change. Simulation then reveals how these elements combine to produce trajectories: booms, busts, plateaus, oscillations, collapses.

A simple but memorable real-world analogue is the **FEMA Waffle House Index**.

Emergency managers in the United States use the operating status of the Waffle House restaurant chain as a quick read on local disaster severity:

- If outlets are fully open, infrastructure is probably mostly intact.
- If only a limited menu is available, supplies or power are constrained.
- If Waffle House is closed, conditions are likely severe.

The index works because Waffle House itself embodies a complex interplay of logistics, labor, infrastructure, and demand. A single, simple indicator captures a great deal of system structure.

System dynamics modeling formalizes this kind of intuition. It helps identify **leverage points** where small changes in rules, information flows, or capacities can have disproportionate effects. It also reveals the **counterintuitive behavior** of complex systems: well-meant interventions that make things worse, quick fixes that erode long-term resilience, or policies that work only under narrow conditions.

Futures Events: Moments of Transformation

Not all change is gradual.

Some futures are shaped by **events**: discrete occurrences that sharply alter trajectories. Futures event modeling focuses on these inflection points – technological breakthroughs, natural disasters, social movements, political shocks – and explores how they "punctuate" otherwise continuous trends.

The challenge is that specific events are hard to predict. We may know that some kind of major pandemic, breakthrough AI, or geopolitical rupture is likely over a given horizon, but not exactly when or in what form. Futures event modeling therefore relies on probability ranges and scenario analysis, asking not only *what* might happen, but *when* and *in what sequence*.

As an illustration, consider the sudden cultural dominance of *Tiger King* on Netflix in early 2020.

This was not, in itself, a global structural event, but it was a revealing microcosm of how a particular moment – lockdowns, anxiety, social isolation – could make a very specific kind of content explode. It blended documentary, reality TV, and online meme culture into something that captured and amplified the zeitgeist. A serious futures exercise would not model *Tiger King* per se, but it would care about how shocks and media ecosystems interact to create shared narratives that shape behavior.

Event modeling is particularly useful for **stress-testing** other simulations and plans.

An urban-development model can be subjected to floods, financial crises, or abrupt technological disruptions; a health-system model can be hit with different outbreak patterns. Models can also explore how **timing and sequencing** matter: the same innovation arriving in a recession versus a boom, or under high versus low institutional trust, may have very different consequences.

Integration and Synthesis

Each simulation approach offers a different lens:

- Agent-based modeling foregrounds individual behavior and interaction.
- System dynamics foregrounds structure, stocks, and feedback.
- Event modeling foregrounds shocks, surprises, and punctuation.

The richest insights come from **combining** them. Multi-method, multi-level simulations can capture both micro-level agency and macro-level constraints, both slow evolution and sudden disruption.

For example, an integrated simulation might use:

- Agent-based components to explore how households, firms, and institutions respond to policy changes or shocks.
- System dynamics structures to represent the broader evolution of resources, infrastructure, and environmental conditions.
- Event modules to introduce rare but consequential disruptions – a pandemic, a cyberattack, a political rupture – at different points in time.

The way KFC handled its 2018 chicken-shortage crisis in the UK – closing outlets, then running a full-page "FCK" apology ad that owned the mistake with humor – was not a product of a formal simulation.

But it is a neat example of reading a complex situation (logistics failure, public frustration, media attention) and choosing a response that changed the system's trajectory: from outrage and ridicule to grudging respect and shared amusement. A good futures model would not predict that exact creative move, but it could help leaders see the range of responses that diffuse rather than amplify damage.

The future of simulation in a polycrisis era lies in three things:

1. **Creative integration** of methods.
2. Thoughtful selection of what to model and what to leave open.
3. And the recognition that the most valuable simulations are not crystal balls, but **shared laboratories**.

Used well, they expand our collective imagination, sharpen our sense of consequence, and provide spaces where different actors can experiment with how to navigate a world that is **fragile, overlapping, nonlinear, interconnected,** and **cascading** – before those experiments have to be run in the real world.

CHAPTER 8

THE IMPERATIVE OF CRISIS PREPAREDNESS

Crisis Simulation in a FONIC Landscape

In earlier chapters, we described contemporary crises as having a characteristic pattern: **fragile** systems, **overlapping** pressures, **nonlinear** escalations, deep **interconnectedness**, and **cascading** effects.

Taken together, this FONIC configuration means disruptions rarely remain local or simple. They propagate quickly across boundaries and mutate as they move.

In such an environment, the capacity to respond to crises is no longer a specialist function but a core organizational and societal competence. Traditional training methods – lectures, case studies, tabletop exercises – still have their place, yet they tend to assume steady attention, linear sequences, and generous decision windows.

Real crises are rarely so accommodating.

This gap between preparation and reality has driven the development of sophisticated crisis simulators.

These are not just "fancier tabletop exercises." They are specialized simulation environments designed to model plausible scenarios and, crucially, to immerse participants in the psychological and operational conditions of crisis: incomplete information, time pressure, conflicting incentives, media scrutiny, and multi-actor coordination.

The evolution of crisis simulation mirrors two broader shifts: advances in technology, and a more nuanced understanding of crisis dynamics. Early simulations focused mainly on technical systems – how infrastructure might fail, how disasters might unfold, how resources might be allocated. Contemporary platforms take seriously the human dimensions: how stress alters cognition, how communication fails, how organizational cultures shape what is even perceived as a "signal."

Conducttr: Military-Grade Realism

Conducttr, developed in partnership with NATO, is a good illustration of how far immersive crisis simulation has come. Originally created for military contexts, it has broadened to support governments, corporations, and NGOs grappling with complex, multi-layered crises.

Its distinguishing feature is psychological realism.

Conducttr does not aim merely to generate technically plausible timelines; it aims to reproduce the emotional and cognitive conditions under which real decisions are made. The underlying assumption is that while technical systems fail in relatively well-understood ways, human responses are shaped by the interplay of individual psychology, group dynamics, institutional norms, and external pressure.

Scenarios unfold in real time. Information arrives in fragments, through multiple channels, with unclear provenance. Participants feel the pressure of simultaneous demands: political, operational, legal, ethical. Conflicting priorities emerge; stakeholders pull in different directions; resource constraints force trade-offs that are uncomfortable rather than theoretical. The exercise deliberately creates the "fog of crisis" analogous to the "fog of war" in military theory.

Conducttr's NATO origins are visible in its focus on **multi-organizational coordination**. Few contemporary crises sit neatly inside one organizational chart. A cyberattack may hit banks, transport operators, hospitals, and governments at once. A major storm may require coordination among local responders, national agencies, the military, and international relief organizations. Conducttr allows participants from different institutions to confront, together, the frictions that arise when divergent mandates, cultures, and systems collide under pressure.

The realism extends to communication.

Participants may need to interpret intelligence summaries, track social media, respond to journalists, and coordinate with field teams at the same time. The platform recreates the multi-channel, multi-audience information environment in which contemporary crisis leadership actually takes place. In debriefs, participants often discover that the fictional malware or flood was not, in fact, the most difficult part. The hardest problem was aligning three real-world departments on the simple question: "Who has the authority to say yes?"

Polpeo: Media-Centric Crisis Management

Polpeo approaches crisis simulation from a different but increasingly decisive angle: the media dynamics that accompany, and often shape, crises.

The platform starts from a simple observation: crises now unfold in **physical systems and information spaces simultaneously**. A transport accident disrupts actual mobility, but the crisis also exists as a rapidly evolving narrative across news sites, social platforms, blogs, podcasts, and message boards. That narrative feeds back into the crisis, influencing trust, compliance, political response, and institutional legitimacy.

Polpeo recreates a richly textured media ecosystem.

Participants must think not only about operational decisions, but about how those decisions will be perceived, contested, and reinterpreted across different channels with different audiences and tempos. A press conference, a tweet, a leaked email, and a delayed briefing can all nudge the narrative in different directions, sometimes more powerfully than the underlying operational realities.

The platform compresses timelines to reflect digital dynamics: physical response may unfold over days, but online narratives can shift in minutes. An unfortunate phrase in a briefing can become a meme that frames public perception for weeks. A vacuum of information is rarely neutral; it is quickly filled by speculation, rumor, and opportunistic framing.

Polpeo also highlights the **globalization of attention**.

Local events can rapidly become transnational stories, filtered through widely differing cultural and political lenses. Participants are forced to confront how a statement crafted for a domestic audience might be interpreted in very different contexts and how these layered narratives can complicate even technically competent responses.

Immersive Labs: Cyber Crisis Specialization

The Immersive Labs Cyber Crisis Simulator addresses a domain where abstraction is often the enemy of preparation: cyber incidents. Cyber crises are unusual in that much of what matters is not directly visible. Attacks play out in logs, packets, and obscure error states. Non-technical leaders may struggle to understand what is happening, while technical specialists may struggle to explain it in decision-relevant terms.

Immersive Labs tackles this by building scenarios that make **the invisible legible**.

Visualization tools, structured timelines, and carefully designed injects allow technical and non-technical stakeholders to develop a shared mental model of what is happening. The simulations foreground the **forensic and temporal complexity** of cyber response. When a breach is detected, teams must simultaneously contain the threat, preserve evidence, maintain critical services, communicate with regulators, customers, and staff, and sometimes coordinate with law enforcement or intelligence agencies. Each task runs on different time horizons and obeys different constraints; they do not line up neatly.

Many of the most damaging cyber incidents have been failures of **detection**, not response. Advanced intrusions may persist for months before being noticed. Immersive Labs therefore places particular emphasis on anomaly recognition and escalation: how signals are noticed, interpreted, and elevated – or missed.

Equally important is the **translation challenge**.

Technical specialists may understand the implications of a compromise but lack a vocabulary that resonates with boards and executives. Leaders may grasp the business stakes but lack the conceptual tools to weigh technical options. The simulator forces these groups to work together under time pressure, making miscommunication visible while there is still time to learn from it.

NPSA: The Internal Threat Challenge

The UK's National Protective Security Authority (NPSA) Insider Crisis Simulations turn the lens inward, focusing on threats that arise from within organizations themselves.

Insider threats are structurally different from external attacks.

They emerge from relationships of trust, often gradually and ambiguously. The motivations involved – financial pressure, personal grievance, ideological shifts, coercion – unfold over time and are entangled with culture, leadership, and everyday practices.

NPSA's simulations are designed around **ambiguity rather than spectacle**.

Participants are not presented with a dramatic betrayal, but with small anomalies: unusual access patterns, minor policy violations, changes in demeanor. The challenge is to recognize the potential significance of these signals without tipping into paranoia.

The exercises also foreground the role of **organizational culture**. Environments where concerns are ignored, feedback is unwelcome, or ethics are routinely stretched create fertile ground for insider compromise. Through simulated narratives, participants see how informal norms and managerial habits can either mitigate or magnify risk.

A distinctive feature of the NPSA approach is its integration of **HR, legal, and ethical considerations**. When an insider threat is suspected, acting too aggressively can damage trust, violate rights, or trigger legal action; acting too cautiously can allow serious harm. Simulations provide a space to rehearse these tensions, test escalation protocols, and explore support mechanisms that combine security with fairness.

The Psychology of Crisis Simulation

Effective crisis simulators differ from simple scenario planning in their attention to **how humans actually think and feel under stress**.

Real crises activate physiological and cognitive responses that narrow attention, increase reliance on heuristics, and reduce working memory. If training assumes calm, unhurried, fully rational actors, it will reliably mislead.

Tunnel vision is a common pattern: under pressure, people fixate on immediate threats and lose track of broader context or longer-term consequences. Simulations can reproduce this narrowing and then embed mechanisms (cross-checks, role rotation, deliberate "pause and scan" moments) that help participants practice restoring situational awareness.

Confirmation bias is another persistent feature. Once an initial narrative takes hold ("this is just a technical glitch," "this is a PR problem, not a safety issue"), new information tends to be interpreted in ways that support it. Well-designed simulations deliberately introduce disconfirming evidence and require teams to decide when to abandon or revise their first story.

The **social dimension** is equally significant.

Crises seldom respect organizational boundaries; they demand coordination across professions, sectors, and hierarchies. Different groups bring distinct languages, values, and implicit assumptions. Simulators make these differences visible, turning them from background noise into material for learning. It is not uncommon for a debrief to reveal that three groups all believed they were "supporting" the same objective while, in practice, they were working at cross-purposes – largely because each group used the same words to mean different things.

Technological Integration and Innovation

Recent advances in technology have expanded what crisis simulators can do.

- Artificial intelligence can drive more dynamic and unpredictable scenario evolution, responding to participant choices rather than following a fixed script. Machine learning can analyze patterns of response across exercises, highlighting recurring weaknesses or blind spots and adapting subsequent scenarios accordingly.
- Virtual and augmented reality add another layer, immersing participants in sensory-rich environments where spatial awareness, physical constraints, and embodied stress responses matter. Walking through a simulated smoke-filled corridor while managing radio traffic and time pressure is a different experience from discussing an evacuation plan in a meeting room.

These technologies are not inherently transformative; they can just as easily be used to create expensive theatre. Their value lies in how thoughtfully they are integrated into pedagogical design: where increased realism actually supports learning rather than overwhelming it.

Embedding Simulation in Organizational Learning

The most effective crisis simulation programs are not one-off events but **embedded components of broader learning systems**. Forward-looking organizations treat simulation as part of a cycle that includes policy and plan development, regular exercises, structured after-action reviews, and continuous refinement. Insights from simulations are translated into changes in procedures, training, infrastructure, and sometimes governance.

A recurring challenge is **transfer**: People may perform well in the simulated environment but struggle to apply lessons in their day-to-day roles, where incentives, constraints, and power dynamics differ. Strong programs invest in follow-up: Coaching, revised workflows, and explicit discussions about how to adapt simulation practices to the realities of the organization.

Culture is central.

In organizations where mistakes are punished, dissent is unwelcome, or hierarchy is rigid, simulation may elicit "ideal" behavior that would never occur in reality. Participants know what they *should* do in theory but also know the informal consequences of doing so. High-quality programs attend explicitly to these cultural frictions, using simulation outcomes to open conversations about how culture supports or undermines effective crisis response.

Future Directions

Crisis simulation is likely to become more tightly coupled to emerging technologies, more tailored to specific organizational contexts, and more attuned to the interdependencies that define modern risk environments.

The underlying aim, however, remains stable: to create structured spaces where individuals and organizations can experience the demands of crisis response without incurring real-world harm; to build capabilities that combine technical literacy, psychological resilience, and collaborative skill; and to cultivate the confidence required to act under genuine uncertainty.

Seen through the lens of this book, crisis simulators are not a solution to FONIC dynamics, but a response to them.

In systems that are fragile, overlapping, nonlinear, interconnected, and prone to cascading effects, we cannot assume that inherited routines will suffice. **What we can do is design environments where people can practice thinking and acting inside that complexity before they are forced to do so for the first time in the middle of the next crisis.**

CHAPTER 9

MODELING THE AGE OF INTERCONNECTED DISRUPTION

Modeling Interdependence, Not Incidents

Contemporary crises rarely stay politely in their lane.

The COVID-19 pandemic did not "just" produce a health emergency; it rearranged labor markets, broke supply chains, disrupted schooling, strained mental health, and intensified political polarization. Climate change is not only about weather; it reshapes migration, agriculture, real estate, security policy, and social conflict.

We are not dealing with single shocks, but with patterns of interaction.

Earlier in this book, we described this pattern with the shorthand **FONIC**: Systems that are *Fragile, Overlapping, Nonlinear, Interconnected,* and *Cascading*. The important point is not the acronym, but the architecture it describes: a world in which interventions in one domain very easily generate second- and third-order effects elsewhere.

Most traditional crisis simulations, however, still treat sectors as largely discrete: a financial exercise here, a climate scenario there, some civil protection planning over there. They struggle to capture the dense web of interdependencies through which crises actually propagate and transform.

A serious polycrisis simulator has to do more.

It must model individual systems and how they fail, but also how those failures propagate, interact, and occasionally combine into entirely new problem types that were not in anyone's original brief.

Cross-Sector Interdependencies

Modern economies are masterpieces of interconnection.

Just-in-time supply chains shave off inventory, financial systems clear transactions across continents in seconds, logistics networks move components and commodities with exquisite timing, and digital communication knits all of this together.

The same architecture that delivers this efficiency also creates structural vulnerability. A disruption in one part of the system can appear, a few steps later, as a shortage, a price spike, a legitimacy crisis, or a political shock in some entirely different domain.

The 2021 **Suez Canal blockage** made this painfully visible. Remember that one from before? One container ship, awkwardly wedged across a shipping lane, managed to:

- Delay deliveries for thousands of firms that had never heard of the vessel.
- Reveal how European supermarkets depended on Asian producers they barely interacted with directly.
- Demonstrate that a physical logistics jam could move financial markets within hours.

A useful polycrisis model does not treat this as an unfortunate anomaly; it treats it as a diagnostic. The task is to surface the **hidden dependencies** before they become crisis multipliers.

Time adds another layer. Some interdependencies operate in real time: a regional grid failure instantly affects communications, transport, and hospitals. Others unfold over weeks or months: slowly accumulating supply shortages eventually halt production lines. Still others are generational: persistent underinvestment in education quietly erodes future workforce capacity until it surfaces as a "skills crisis" in some other chapter.

Simulation that takes interdependence seriously has to reflect these different tempos. It must help users see how today's emergency workaround can become tomorrow's structural vulnerability. A manufacturer that "temporarily" centralizes suppliers during a crisis to save costs may, two years later, discover it has written the script for a future single-point-of-failure story.

Cascading Impacts: When One Problem Becomes Five

Cascading impacts describe how stress in one domain travels through others, often changing form along the way. Unlike simple cause-and-effect chains, cascades are nonlinear: small shocks can sometimes produce system-wide transformations, while major hits may occasionally be absorbed with little visible effect.

The **2008 financial crisis** is the canonical example. What began as localized defaults on subprime mortgages in parts of the United States moved through securitized products, balance sheets, and interbank lending into:

- Global credit freezes.
- Large-scale unemployment.
- Housing collapses.
- Fiscal crises.
- Political instability and populist backlash.

Financial engineering had woven together actors and markets that appeared unrelated. When stress hit, the structure conducted it globally.

For polycrisis purposes, the important questions are not just "what failed?" but:

- **Which systems did the stress move into?**
- **Which resources became bottlenecks as multiple systems started drawing on them at once?**
- **Where did a loss of resilience in one domain quietly erode resilience elsewhere?**

A good simulator makes these trajectories visible, allowing decision-makers to see how a disturbance in, say, fertilizer production might reappear months later in food prices, sovereign risk, and social unrest.

Vulnerability Mapping

If cascading impacts are the behavior, **vulnerability mapping** is the pre-emptive diagnostic. It is the capacity to identify critical linkages, single points of failure, and structural weak points before they become headlines.

This goes well beyond drawing boxes and arrows between infrastructure systems. It involves asking:

- Which connections matter most under which conditions?
- What happens if this node, not that one, fails under stress?
- Where do technical dependencies intersect with human and institutional ones?

Human and organizational factors are frequently where simulations become interesting. A supposedly "redundant" technical system may, in practice, depend on one overworked specialist who knows how it actually functions. A beautifully designed emergency process may hinge on a regulatory approval that can only be signed by someone who is not reachable on weekends.

Polycrisis simulators that ignore these mundane facts of organizational life risk producing elegant models of imaginary systems. On more than one occasion, "call the vendor" has turned out, in a real crisis, to mean "wake up the only person who still understands a legacy database written in a language nobody has taught for 20 years."

Simulating Cascades and Feedback

Complex systems rarely behave in straight lines.

Small interventions can have large consequences; large interventions can mysteriously fizzle. Feedback loops can stabilize behavior or accelerate it into runaway spirals. Time delays between cause and effect often obscure these relationships until crisis reveals them.

Polycrisis simulation therefore has to do two difficult things at once:

1. Represent feedback loops, thresholds, and emergent patterns with enough fidelity that they behave in recognizably complex ways.
2. Avoid becoming so intricate that nobody understands how the model works or trusts its results.

A common strategy is **multi-level modeling**:

- **Agent-based components** capture how individuals and organizations perceive, decide, and adapt.

- **System dynamics components** represent stocks, flows, and feedback at sector or system level.
- **Network representations** describe who and what is connected to whom.
- **Event structures** specify the timing and sequencing of shocks and interventions.

The art lies in the interfaces: deciding what passes between levels, on what time scales, and at what resolution, and then validating this against real cases where similar cascades have actually occurred.

Architectures of Cascading Effects

Global supply chains are among the most visible architectures of cascading effects.

Their very success depends on spreading processes across geographies, organizations, and time zones, which also makes them excellent conductors of disruption.

A factory shutdown in one region can turn into:

- Layoffs and reduced demand in another.
- Fiscal stress in a municipality that depends on local tax revenue, and
- Sudden "discovery" that a surprising number of products share the same upstream component.

In some cases, attempts to adapt create new vulnerabilities. Firms that reconfigure their supply bases in response to one crisis may inadvertently concentrate risk elsewhere, swapping one single point of failure for another.

The strange loop where fertilizer plant shutdowns led to industrial CO_2 shortages, which then threatened beer and soft-drink production, is a good reminder that the path from "we had to close a plant" to "people are panic-buying lager" is not as long as one might think.

Critical Infrastructure Interdependencies

Power, water, telecommunications, and transport systems form the infrastructural substrate of contemporary life. They are also deeply interdependent.

Power failures, for example, can quickly affect:

- Water treatment and pumping.
- Telecommunication networks.
- Traffic management and rail operations.
- Hospital systems and cold chains.

Conversely, disruptions in transport can hinder maintenance of power lines; telecom failures can slow coordination of repairs; climate-driven extremes can push all systems toward limits they were not designed for.

Infrastructure built around historical climate patterns is now encountering new frequency and intensity profiles for storms, heatwaves, and floods. Simulation can help explore where these old design assumptions are likely to fail and how that failure would move through the wider system.

Financial System Contagion

Financial systems are almost purpose-built for cascades. Interbank lending, derivatives, shared platforms, and correlated positions tie institutions together in tightly coupled networks.

Stress can spread through:

- Direct exposures (one institution's loss is another's asset disappearing),
- Loss of confidence (runs and fire sales), and
- Second-order effects in the real economy (credit withdrawal, investment freezes, currency swings).

The feedback loop between finance and the "real" economy is especially important.

Financial stress constrains credit to businesses and households; those constraints depress activity; depressed activity worsens financial metrics. Polycrisis simulations need to represent this two-way coupling, not treat finance as either a detached overlay or a simple mirror.

Institutional Breakdown Patterns

Institutions that normally stabilize systems – governments, markets, communities – can themselves become sources of instability in polycrises. Breakdown often follows a pattern:

- **Overload:** demands exceed capacity.
- **Legitimacy erosion:** perceived failure leads to distrust.
- **Coordination failure:** actors retreat into silos or competition.

Emergency systems designed around single-domain events may struggle when crises span health, energy, finance, and social cohesion simultaneously. Markets that typically allocate resources efficiently may seize when uncertainty makes risk unpriceable. Community networks that provide informal support in "ordinary" disasters may be overwhelmed when stressors accumulate.

Simulation that ignores these institutional dynamics risks assuming the very robustness that polycrisis calls into question.

Information System Cascades

Modern crises are also information crises. Our societies depend on complex information systems to coordinate action, and those systems can either dampen or amplify disruption. Stress appears in several ways:

- **Overload:** too much data, too fast, from too many sources.
- **Fragmentation:** actors working with incompatible or outdated situational pictures.
- **Distortion:** rumor, misinformation, and conspiracy narratives spreading as quickly as accurate information.

Social media can accelerate both effective mobilization and destructive rumor. Filter bubbles produce mutually incompatible realities in which agreement on basic facts is itself contested.

Polycrisis simulation has to take these dynamics seriously: what people *believe* is happening will shape behavior just as much as what is “actually” occurring. Just to recap, during several recent crises, the rumor that “toilet paper is running out” traveled faster than any virus and, for a few surreal days, made itself true.

Simulation Architecture and Design Principles

No single modeling approach can do justice to all these layers. Agent-based models can capture heterogeneous behavior but choke on scale and temporal depth. System dynamics can illuminate structural patterns over time but flatten behavioral nuance. Network models reveal connectivity but struggle with evolving relationships and decision processes.

The way forward is **hybrid architecture**: using different approaches where they are strongest and making sure they talk to each other coherently. That might mean:

- Agents operating on a networked substrate whose macro-dynamics are also represented in system-dynamics form;
- Event generators that introduce shocks based on probabilistic assumptions;
- Interfaces that translate between micro and macro variables.

Equally important is **epistemic humility**.

Models are not oracles; they are structured conversations with uncertainty. Good design makes it obvious where the model is strong, where it is thin, and which behaviors are robust across many parameter choices versus those that appear only under narrow assumptions.

Stakeholder Engagement and Co-Design

Polycrisis simulation without stakeholders is just an expensive way to talk to yourself.

Emergency managers, business leaders, community representatives, technical specialists, and policymakers all hold partial, situated knowledge:

- Emergency services know where protocols fail at 3 a.m.
- Firms understand supply chain quirks and contractual traps.
- Communities know which vulnerabilities do not show up in official statistics.
- Engineers know what breaks in practice rather than in design documents.

Co-design brings these perspectives into the modeling process itself rather than appending them as an afterthought. Stakeholders help specify dynamics, validate behaviors, and interpret outputs. They also learn, in the process, what the model can and cannot say.

This approach does two things: it makes the simulator more empirically grounded, and it builds a constituency that understands how to use its insights rather than treating it as a mysterious black box.

It is often in a co-design workshop that someone casually points out, "That's not how trucks actually get into the city," and an entire branch of a carefully crafted model quietly implodes. This is not failure; it is the point.

The Future of Polycrisis Simulation

Building polycrisis simulators is not only a technical project; it is a political and cultural one. These tools can easily become instruments of false certainty: polished dashboards that imply more precision than the underlying assumptions justify.

Used well, they do the opposite. They help people see where knowledge is thin, where systems are more tightly coupled than expected, and where interventions might have surprisingly broad consequences. They support **collective intelligence**: groups learning together how their world behaves.

The aim is not to predict the next crisis in detail.

In a FONIC environment, that is a losing game. The aim is to prepare people to operate more intelligently when – not if – the next fragile, overlapping, nonlinear, interconnected, cascading mess arrives.

Step-by-step simulation walkthroughs, dynamic visualizations, and narrative scenarios can guide stakeholders through complex causal chains. Interactive exploration and co-creation tools allow them to test assumptions, surface disagreements, and rehearse strategies before reality forces the issue.

In that sense, polycrisis simulation is less about forecasting than about rehearsal: practicing how to think, decide, and collaborate in a world that refuses to sit still.

PART 4

Upwards and Onwards

CHAPTER 10

NAVIGATING THE POLYCRISIS PARADIGM

Biblical Plagues or the New Normal?

In 2020, farmers in Samburu County, Kenya found themselves overrun by a plague of desert locusts – the worst outbreak in 70 years – with swarms ravaging crops across ten countries and threatening nearly five million people with starvation.

This disaster would be dire on its own, but it struck **in the middle of a global pandemic** that had already upended supply chains and left the region's food systems teetering. COVID-19 lockdowns even delayed critical pesticide shipments, giving the insects free rein to multiply. In a matter of weeks, **fragile** agricultural, health, and economic systems began **failing in unison**, each breakdown amplifying the next.

Such a cascading crisis sounds like a biblical plague, but instead shows the increasing normality of a **polycrisis** – a crisis where disparate shocks collide through interconnecting systems, so that the whole emergency becomes more overwhelming than the sum of its parts.

In this East African saga, a climate-fueled ecological disaster ignited a food security emergency, which was then compounded by a worldwide health catastrophe.

The outcome was *not* just two problems at once, but a single, entangled calamity that **spanned sectors and borders**, defying the usual playbook of emergency management.

This unnerving episode is a vivid reminder that in our era of tightly linked vulnerabilities, one disturbance can rapidly escalate into a multiheaded crisis – a preview of the polycrisis predicament the world now faces.

From the **Pegasus spyware** quietly infiltrating politicians' and journalists' phones to the **colonial pipeline hack** that spurred fuel panics across the U.S. East Coast, recent shocks come in flavors both physical and virtual – and often all at once. Some are freak accidents or acts of nature, others are deliberate acts of malice, many are slow-brewing failures of design.

In 2008, **Iceland's entire financial system imploded**, with *90% of its banking assets failing in the span of a week*. This tiny nation's collapse toppled its government and "poisoned relations" with the UK and Netherlands as they bickered over bailout costs. A local banking crisis, born of excessive debt and hubris, cascaded into a diplomatic showdown and a test of global financial safeguards.

In Texas, a once-in-a-generation freeze exposed how a proud, isolated energy grid could turn into a *"set of misery dominoes"*: power plants went down, which knocked out water systems and food supply chains, which in turn hamstrung medical services and even *COVID-19 response*. What began as a weather event became a systemic meltdown, killing hundreds and causing an estimated **$300 billion** in losses.

Such examples underscore a sobering truth: we live in an age where crises no longer stay in their lane.

We face not isolated disasters but entangled **polycrises**, in which fragile systems, overlapping hazards, nonlinear chain reactions, deep interconnections, and cascading failures combine to create catastrophes far greater than the sum of their parts.

From One Thing at a Time to FONIC

Traditionally, a "crisis" was something we could put boundaries around – a discrete event in a specific sector or location. An earthquake, a bank run, a cyber breach, a pandemic: each would typically be managed by the relevant silo of experts.

But today's crises behave more like a network than a singular event.

They propagate and morph. A shock in one domain triggers disruption in another, which loops back to amplify a third. The **anatomy of a polycrisis** can be discerned through a few key features:

- **Fragility**: Modern systems optimize for efficiency and speed, but in doing so often trade away buffers and resiliency. The result is highly brittle infrastructure that works **just-in-time** until something goes wrong. The Ever Given's saga laid bare how a **pinch point** like Suez can cripple global trade because our supply chains are "stretched, incredibly stretched" – efficient, yes, but lacking slack for surprises. Likewise, Texas's power network, engineered for fair weather and market logic, had **no margin for error** when faced with extreme cold. In a polycrisis, the initial disturbance finds our systems ready to crack.

- **Overlapping Crises**: Polycrises rarely come singly. They are **convergent by nature**. Timing is cruel: one crisis arrives before the previous one departs, or two build in tandem and collide. During the 2021 chaos, a viral pandemic, climate-fueled disasters, supply chain failures, and geopolitical conflicts all overlapped and fed into each other. Overlap turns difficult situations into intractable ones. It also makes attribution tricky – was it the drought or the economic sanctions that caused a food crisis? The answer is *both*. Overlap means **no single cause** can be isolated; instead, multiple stresses twist together into a knot. This is why a regional **locust infestation** in East Africa became so devastating in 2020 – it struck amid COVID-19 and economic turmoil, each crisis amplifying the others' harm. An overlapping crisis is a **force multiplier**: challenges that might be managed individually become unmanageable when they sync up.

- **Nonlinearity**: In complex systems, effects are rarely proportional to causes. Small triggers can yield **outsized consequences**, and changes can accelerate exponentially. Feedback loops and tipping points lurk. Polycrises exhibit nonlinearity at every turn – think of how a minor software vulnerability in an obscure Ukrainian accounting program unleashed *NotPetya*, a malware worm that paralyzed shipping, pharma, and logistics companies worldwide overnight. That cyberattack, intended as a pinprick against one country, cascaded unpredictably into a **$10 billion global outage**, crippling ports and corporations an ocean away. As one observer noted, it was like “using a nuclear bomb to achieve a small tactical victory”. Nonlinear escalation means **we can’t rely on intuition** (which expects neat cause-effect); instead, we must expect the sudden and the strange. A single spark can ignite a conflagration of systemic failures.

- **Interconnectedness**: Everything is connected – often in invisible ways – and polycrisis thinking maps those linkages. Globalization and digitalization have wired together economies, ecologies, and institutions at a density our ancestors never knew. This brings great benefits and **great vulnerabilities**. In a polycrisis, distant nodes of the network become proximate. A **cyber war blast in Ukraine** blows back on a Danish shipping line, which in turn stalls factories in East Asia and retailers in America. A **financial panic in New York** can wipe out pensions in Reykjavik and construction projects in Nairobi. The NotPetya episode showed how “an attack aimed at Ukraine strikes Maersk, and an attack on Maersk strikes everywhere at once,” as WIRED memorably put it. Interdependence means that *no crisis is ever truly local anymore*. Our tightly knit world can transmit shocks the way a body’s bloodstream carries toxins. But the flip side is also true: solutions and support can spread just as quickly through those same interconnections – if we learn to use them.

- **Cascading Failures**: Finally, a polycrisis features domino effects – one failure tipping into the next. **Cascades** are the hallmark of systemic breakdown. The Texas Cold Wave began with frozen instruments and spiking energy demand, but it didn’t end there. Power plants tripped offline, which **knocked out water treatment plants**, which **contaminated water supplies** and left entire cities under boil notices. Pipes burst in unheated homes, flooding buildings. Food spoiled as refrigeration failed. Hospitals struggled as backup generators ran out of fuel. *“An astounding cascade of linked failures occurred, falling like a set of misery dominoes,”* one post-disaster report concluded. Crucially, these dominoes often fall across **sector boundaries**: an energy crisis becomes a water crisis becomes a health crisis, as each infrastructure network is connected to others. In contrast, a contained crisis might wreak havoc in one realm (say, an isolated internet outage) but *stop* at the firewall of other systems. Polycrises don’t stop; they break the firewalls. *Cascading* means that even if each part was resilient on its own, their interdependence creates new failure modes. It’s the chain reaction that turns a bad situation catastrophic.

By examining these features – fragility, overlapping stressors, nonlinear dynamics, interconnections, and cascades – we can **distinguish a truly systemic polycrisis from a merely headline-grabbing disruption**.

Not every big disaster qualifies.

A temporary fuel shortage or a one-day stock market crash might cause alarm, but if it doesn’t embed itself into other systems or spawn further crises, it remains a serious but single event.

Polycrisis is something more **synergistic and pernicious**. It’s the difference between a solitary tree falling and an entire forest catching fire. In an age when pundits and PR departments love to cry “crisis!” at every challenge, this framework offers a dose of discipline.

It urges us to ask: *Are we dealing with separate fires that coincidentally burn at once, or a firestorm feeding on itself?* Polycrisis thinking is about seeing the firestorm – and realizing that **our era's emergencies demand an entirely new approach**.

A New Paradigm (Not a New Buzzword)

It has become fashionable in recent years to toss around the term "polycrisis" at conferences and in think-tank reports. Indeed, the word shot to prominence after the COVID-19 pandemic and Russia's invasion of Ukraine, when leaders sought a concept to describe the chaos of simultaneous global challenges. Some critics have dismissed it as the buzzword du jour – a trendy label that complicates more than it clarifies.

But as we reach the culmination of this exploration, let's make one thing clear:

Polycrisis thinking is not a fad. It's a necessary reframing of how we understand systems in crisis.

It marks a paradigm shift as profound as the move in past generations from seeing diseases as isolated illnesses to recognizing an underlying syndrome. In the words of the UN's risk reduction experts, *"a transition is needed from one paradigm to another – from managing disasters to managing risk – and from managing 'conventional' hazards to… understanding… systemic risks".*

In plain terms, we must stop treating crises as one-off unfortunate events and start anticipating them as emergent properties of the systems we've built.

Paradigm shifts begin with awareness.

We can no longer afford the luxury of believing that a crisis in one sector will remain contained. The old mental model – where we had, say, a health crisis *here* and an economic crisis *there*, each handled by separate plans – is obsolete.

Polycrisis is a lens that connects the dots.

It forces us to see, for example, how a pandemic can ignite an economic recession, which fuels political extremism, which in turn might hamper the pandemic response, creating a vicious cycle. It prompts us to analyze not only *nodes* (the individual crises) but also the *edges* between them – the lines of influence, feedback, and contagion that traditional risk management tended to ignore.

Crucially, polycrisis thinking also guards against **complacency and siloed optimism**. It is inherently interdisciplinary. A climate scientist, an economist, and a cybersecurity analyst might all be worrying about different "worst case scenarios" – a mega-hurricane, a banking collapse, a digital infrastructure failure.

Polycrisis says: those scenarios can, and likely *will*, intersect. Instead of planning for each in isolation, we have to plan for their intersections.

This doesn't mean every bad thing will happen at once, nor should we live in doom and gloom. Rather, it means our *strategies for resilience must be as interconnected as the crises themselves*. We have to break the silos in our institutions and mindsets.

The **international community is slowly waking up** to this reality – the World Economic Forum's Global Risks Report in 2023 identified "polycrisis" scenarios where the convergence of risks amplifies the damage. But awareness is just the first step toward change.

The real test of this new paradigm will be whether we can translate holistic awareness into holistic action.

Let's also dispel the notion that calling something a polycrisis is defeatist or alarmist.

On the contrary, recognizing a polycrisis is the first step to being **empowered to handle it**. If you don't see the whole picture, you'll forever be chasing spot fires while the larger blaze grows.

Polycrisis thinking, properly applied, is optimistic: it implies that by understanding the connections, we can get ahead of the disaster instead of being constantly surprised.

In the 1960s, facing a slew of environmental crises, systems theorists began to urge a "systems approach" to problems – leading eventually to breakthroughs like the Montreal Protocol (which solved the ozone crisis by seeing industry, science, and governance as one system).

Today, facing a polycrisis of climate change, inequality, technological disruption, and conflict, we need a similar leap. We must develop a *"polysolution" mindset*: solutions that address multiple issues at once, or one solution that mitigates one risk without exacerbating another.

This is not a buzzword bingo; it's **strategic realism for a complex era**.

In sum, adopting the polycrisis paradigm means embracing complexity without succumbing to paralysis. It means training ourselves – whether policymakers, business leaders, or community organizers – **to think in networks, feedback loops, and scenarios**, rather than in linear cause-and-effect.

It's a humbling shift (because it acknowledges uncertainty and surprise) but also a hopeful one (because it uncovers leverage points where a smart intervention can have outsized preventive impact).

The polycrisis lens tells us that **resilience in the 21st century must be systemic**.

We can no longer measure our safety by the strength of each individual pillar; we have to ensure the entire structure can flex and not collapse when the earth shakes on multiple fault lines at once.

Simulation, Coordination, and Design: Tools for an Unruly Era

How do we navigate this volatile, tightly coupled world without being overwhelmed?

The final note of this chapter – and of this book – is a hopeful one: we **do** have tools and emerging practices to meet the challenge. By harnessing **simulation, coordination, and design**, we can chart a path through the polycrisis – not by predicting every twist, but by preparing to **adapt** and **respond** with agility and foresight. Think of it as cultivating an immune system for civilization: we can't stop every germ from entering, but we can build robustness to prevent collapse.

Simulation – in the form of scenarios, war-gaming, and computer modeling – is our way of rehearsing the future so we're not caught flat-footed. If crises are going to come in combinations, then we should practice in combinations. This means going beyond the traditional *single-disaster drill* ("What if a Category 5 hurricane hits our city?") to *multi-disaster simulations* ("What if a hurricane hits during a cyberattack and a financial panic?").

Forward-looking organizations have started to conduct exactly these kinds of **stress tests**.

In 2022, a team of futurists ran a "**Polycrisis 2040**" exercise where each hour of simulation brought a new crisis to layer atop the last, forcing participants to think and act under compound stress.

Banks and regulators are exploring how to **stress-test financial systems against concurrent shocks** – for example, what if a climate disaster and a market crash happen simultaneously? Such simulation work, once niche, is becoming essential.

The idea is not to accurately predict what will happen (the exact scenario likely won't repeat), but to **build muscle memory and cross-sector relationships** for when something *does* happen. When leaders have mentally walked through a dozen nightmare scenarios, the real thing – however novel – is less paralyzing. Simulation also uncovers hidden interdependencies: by modeling how a crisis propagates, we often reveal a "single point of failure" that no one noticed in normal times.

It's much better to find those in a virtual drill than amidst real chaos. Yet simulation alone is not enough. We can simulate until we're blue in the face, but if we don't act on the insights, it's just theater. This is where **coordination** comes in. Polycrisis demands that *we work together in ways we're not used to*. One of the glaring lessons from every recent disaster is that siloed responses fail. During the Texas blackouts, electric grid operators didn't effectively communicate with natural gas suppliers, who in turn hadn't been looped into weather emergency plans – a lack of coordination that proved calamitous. Conversely, in crises where agencies and sectors *did* coordinate (for instance, the COVID-19 scientific community sharing data globally at unprecedented speed), the outcomes improved. **Coordination is a technology of mindset and governance**. It means breaking down the walls between disciplines: utilities working with climate scientists, city mayors with cybersecurity experts, central bankers with epidemiologists. It means establishing networks of trust before things go wrong. Some countries and cities are now setting up dedicated *"resilience offices"* or cross-agency task forces that convene regularly to swap insights on risk. There is talk of appointing "Chief Risk Officers" in government who look holistically across portfolios.

At the global level, initiatives like the **UN's Global Risk Assessment Framework (GRAF)** aim to gather diverse stakeholders to share data and models of risk. Coordination also has a very immediate, operational side: in a polycrisis, you might have to prioritize which problem to tackle first, and that triage can only be done with input from all sides. Imagine a future scenario where a cyberattack knocks out satellite communications during a hurricane – who is in charge? Without pre-planned coordination structures, we'd have *chaos on top of chaos*. With them, we have a fighting chance to allocate resources smartly and avoid gaps or duplications in response.

Finally, we arrive at **design** – perhaps the most long-range tool, but arguably the most powerful.

Design is about **building systems that are inherently more resilient, flexible, and self-healing**. If simulation and coordination are about how we respond *during* a polycrisis, design is about what we create *beforehand, in peacetime*, to reduce the odds of a collapse. This spans engineering, architecture, economics, and even the design of organizations and institutions.

A classic example is the push for more **resilient infrastructure** after repeated disasters. Rather than rebuilding the grid or the bridge or the supply chain exactly as it was, forward-thinkers advocate *designing it differently*: adding redundancies, fail-safes, and diversification.

The concept of **microgrids** for electricity is one such design principle. Instead of one giant grid that can fail spectacularly, a network of microgrids can isolate failures and "island" themselves to keep critical services running even if the main grid goes down. This is a design that embraces autonomy and interconnection in balance – it's harder for a cascade to take out everything when subsystems can decouple as needed.

Similarly, in supply chains, companies are now redesigning logistics with multiple sourcing options and inventories in different regions so that a single factory fire or one blocked canal doesn't halt production worldwide. The idea of *"secure by design"* is gaining traction in technology: build software and hardware assuming hostile conditions, so that a cyberattack finds fewer open doors.

In finance, regulators talk about *"macroprudential design"*, meaning you set up rules that prevent banks from all failing at once – for instance, by requiring buffers that account for correlated risks.

Even our cities can be reimagined: urban planners are asking how to design cities that can handle a heatwave and a flood and a pandemic concurrently – say, by creating more green spaces (which reduce heat and absorb water), strengthening public health systems, and ensuring social networks in neighborhoods to check on vulnerable residents.

Design is also about **imagination**.

It asks: how would we build this system if we assumed from the start that it would face novel shocks and multiple stresses? It shifts the goal from pure efficiency to *robustness*.

A telling statistic: after the Texas blackout, analysts calculated that *every dollar invested in weatherizing equipment and improving grid design would save several dollars in disaster losses down the line*.

The same likely holds true across many domains – preventive design is simply more cost-effective than post-disaster repair. And beyond cost, there's human dignity: designing society to absorb shocks means fewer lives upended when crisis strikes.

It means **bouncing back faster**, or even better, *"bouncing forward"* – using the rebuild to improve on what was there.

For example, when a coastal city's seawall is breached by an unprecedented storm surge, the design approach would argue: don't just patch the wall, redesign the whole coastal defense system (maybe integrate wetlands as natural buffers, rethink zoning, etc.) so that *next time, the city laughs off a storm that would have once been devastating*.

Over time, with this approach, tomorrow's crises become less deadly and less disruptive.

In weaving together simulation, coordination, and design, we start to see a powerful emerging vision for navigating a turbulent world. We won't pretend it's easy. Each of these tools requires investment, political will, and creativity to implement.

But the encouraging news is that **pockets of progress** exist.

Multinational simulations of pandemic responses are happening. Cities from Rotterdam to Singapore are redesigning infrastructure for climate resilience. Tech firms are coordinating on cybersecurity threat intel as never before. Financial authorities are finally talking about systemic risks like climate and cyber in the same breath as interest rates and inflation.

These are the embryonic beginnings of what could become a new norm: a civilization that *plans and builds for complexity*, rather than assuming simplicity.

The Final Movement: Provocations for a Resilient Future

As we conclude this journey through crises and complexity, it's worth pausing in this closing crescendo to reflect – and to provoke.

After all, a finale should not only summarize, but also **ignite something in the imagination**.

So let us dare to look ahead, beyond the crises of the moment, and envision what navigating a polycrisis age could mean in practice. Consider these parting provocations, not as definitive answers but as catalysts for your own thinking:

- **What if we treated every near-miss and disruption as a *learning simulation* rather than a one-off anomaly?** A ship blocks a canal – do we simply unblock and move on, or do we war-game the scenario where *two* major canals are blocked, or where a blockade lasts months, and use that to reform global shipping protocols? Every crisis contains lessons; a polycrisis mindset insists we wring insight from each and inject those insights into future plans.
- **Imagine a world where governments and corporations hold "polycrisis drills" as routinely as fire drills.** Once a year, your city runs a 24-hour exercise: a cyberattack, a flood, and a misinformation campaign all hit at once – and officials practice cooperating under that pressure. Executives gather their division heads to simulate a scenario where supply chain, PR, and legal crises coincide, forcing them to break conventional hierarchies and respond creatively. It sounds expensive – until you consider how expensive *not* being prepared proved to be in reality. The key is **institutionalizing foresight**: making it standard to think weird, to ask "and then what?" five times for every risk.

- **Could we design institutions explicitly for complexity?** Our current ministries and departments are largely 20th-century creations, each optimized for a silo (health, finance, defense, etc.). Perhaps it's time for new entities – maybe a **Department of Interdependence** or an **Office of Complex Risks** – whose job is to span silos and ensure joined-up thinking. Or less grandly, empower agile task forces that assemble experts from many fields to troubleshoot emerging threats (some countries did this ad-hoc in the face of COVID-19; we could make it permanent). What might democracy look like when voters demand polycrisis competency – leaders who grasp ecology, economy, technology as an integrated whole? Could elections be won (and crises averted) on the strength of coalition-building and scenario-planning skills, rather than just charisma or single-issue platforms?

- **Where are the positive cascades?** We've talked about cascading failures; but systems can cascade strength as well. Is it possible to trigger virtuous domino effects – where a breakthrough in one field (say, cheap clean energy) alleviates stress in others (reducing resource conflicts, cutting carbon emissions, creating jobs)? Polycrisis thinking can also be **"polytunity"** thinking, to borrow a recent coinage – seeing in our interconnected fate not just shared risk but shared opportunity. The same connections that transmit shocks can also transmit innovations and solidarity. If global supply chains can spread a shortage, they can spread a surplus just as fast. If a pandemic can go worldwide, so can a cure. This isn't naive optimism; it's a design principle: *amplify the upsides* as aggressively as we dampen the downsides.

- **Are we ready to embrace humility and radical collaboration as core operating principles?** The polycrisis era may render moot the old badges of honor like "superpower" or "market leader." When problems are hyper-complex, the only rational way forward is **together**. This entails some bold rethinking: sharing data that was once guarded, co-developing solutions with unlikely partners (cities learning from militaries, startups guiding governments, indigenous communities teaching scientists about resilience drawn from centuries of knowledge). It might mean admitting "we don't know" more often, and then *investing in finding out*. It certainly means **rethinking success**. In a stable world, success was growth and efficiency. In a polycrisis world, success might be measured in resilience, adaptability, and fairness – qualities that make a system better at weathering storms. What if nations vied to be the most **resilient society** rather than just the biggest economy? What if companies were valued for their **anti-fragility** – the capacity to thrive amid disorder – and not just quarterly profits?

Finally, let's end on a **visionary note**.

Picture the world a generation from now. It's 2045. Humanity has been through a crucible of crises – some expected, some completely unforeseen. But imagine that by 2045, we have built an international coordination network as advanced as our financial system or our internet is today – a kind of *"planetary crisis radar and response"* system.

The moment a new risk is detected, this network springs into action: simulations churn out options, emergency reserves of critical goods activate across continents, expert teams convene in virtual war-rooms, local responders are empowered by global data, and leaders communicate transparently to keep public trust.

In this world, a hurricane hitting a metropolis during a cyberattack and a pandemic would still be tough – people might still suffer – but it would no longer be a blindside apocalypse.

It would be **managed chaos**, met with discipline and creativity, much as a highly trained orchestra can improvise when a conductor suddenly falls ill, each musician aware of the others and ready to adapt.

This is not a utopia. It's an attainable level of global maturity, if we choose to invest in it. It hinges on us embracing the paradigm shift now, while the lessons of the 2020s are fresh.

The closing chord of our discussion is thus a call to **action and imagination**.

The age of polycrisis is upon us – this we cannot deny. But an age of *polyresponse* and *polyresilience* is ours to create. We have at our disposal the tools of simulation to illuminate the dark corners of the future, the power of coordination to unite our fragmented efforts, and the genius of design to reshape the very systems that underlie our lives.

The task is immense, yes.

The future will no doubt surprise us, sometimes unpleasantly. Yet, if there is one takeaway from all of this, let it be a reframing of mindset: **no longer seeing crises as isolated curses, but as a complex challenge we are capable of mastering**.

In music, a crescendo builds tension only to resolve into a final harmony. Perhaps the polycrisis is the tension of our time, pushing us to the brink, so that we are forced to resolve into a new harmony of human ingenuity and solidarity. It is our charge to ensure that the many crises do not overwhelm us, but instead compel us to become cleverer, kinder, and more connected than ever. If we succeed, future generations may look back on the early 21st century not just as an age of crises, but as the dawn of a *new resilience*, when we learned to dance with complexity and design a world that could withstand it.

The last note has been struck; the crescendo fades.

The question lingers: **What will you, the leaders and thinkers of today, do with this new understanding?** The score is unwritten and the baton is in our hands. Let's compose a future where even the fiercest storm finds us ready, together, and unafraid.

CODA: THE POLYCRISIS AND THE MACHINE

The lights are dimming, and the hour is late.

We must confess: Throughout these chapters on polycrisis, we have barely spoken of artificial intelligence. Perhaps out of caution or denial – a quiet fear that naming the machine mind might summon yet another crisis into an already teetering world. But here we are at last, daring to ask: **What does it mean that the most transformative technology of our age has been a background character in our polycrisis narrative?**

By sidestepping AI in the main text, we may have revealed something about ourselves. Humans often keep new, inscrutable forces at the periphery until they demand center stage. AI's capabilities have been humming in the background – felt but rarely named.

Now, in this coda, AI steps into the spotlight. It is no longer just a tool shaping the backdrop; it's a lead actor that can trigger, amplify, or temper the very polycrises we have mapped. If a polycrisis is a tangle of fragile systems and cascading failures, then AI is both a knife to cut through the tangle *and* a wild thread weaving itself in.

What do AI's advances mean for the emergence of crises, their spread, and their resolution?

At its worst, AI can spark new kinds of breakdowns — algorithmic trading precipitating flash crashes, misinformation bots igniting social panic. It can spread chaos at machine speed: a single software glitch might reverberate globally in seconds, a biased model might quietly inflame inequality across societies.

Yet at its best, AI could help us mitigate polycrises, serving as an early warning system that spots weak signals or a rapid coordinator that organizes response. In short, AI has changed the tempo of crisis itself, pushing everything into a higher gear.

FONIC in the Age of AI

We also need to revisit the FONIC lens – Fragile, Overlapping, Nonlinear, Interconnected, Cascading – now cast in the glow of intelligent machines.

How does stronger AI impact each facet of a polycrisis?

- **Fragile:** AI thrives on optimization. It tunes systems to peak efficiency at the cost of slack and redundancy. But a system optimized to the razor's edge is brittle. Imagine supply chains run by algorithms that erase every buffer; they work brilliantly until a single shock (a port closure, a factory fire) triggers a worldwide breakdown. Yet the same AI can be turned to resilience: Predictive models flagging weak links and looming failures before they snap. We face a choice – use the machine's brilliance to **reduce** fragility or let its blind pursuit of efficiency **increase** it.

- **Overlapping:** Polycrises span domains, and AI is a connector across domains. A single algorithm might manage traffic flows, energy grids, and medical logistics at once. This means a failure in one AI-managed domain can spill into others – a glitch in an AI traffic system could snarl city supply chains and hobble emergency services. Conversely, AI's integrative power can illuminate hidden overlaps. By analyzing data across silos, it might reveal how a drought (environment) could trigger migration (social) and then financial stress. Will AI be the bridge that **transmits** shocks across sectors, or the tool that **maps** and helps mend the joints between them?
- **Nonlinear:** Small causes can yield giant effects in complex systems, and AI can both trigger and clarify such nonlinear events. On one hand, a minor bug or unexpected interaction between algorithms might cascade into an outsized catastrophe – a trivial error that leads to a massive network outage or market meltdown. On the other, AI can help us foresee tipping points by simulating myriad scenarios and detecting subtle patterns humans miss. It can warn when we're nearing a critical threshold, whether in climate, infrastructure, or society. Thus, AI might act as a chaos multiplier, but also as a high-powered seismograph for the tremors of change.
- **Interconnected:** Our world is tightly interwoven, and AI is knitting it even tighter. Algorithms trade with algorithms; machines talk to machines. A disturbance in one node (say a cyber-attack on an AI-controlled grid) can send shockwaves through many sectors. A tightly coupled system means a failure rarely stays local. Yet AI can also guard our interconnections, detecting anomalies in real time and isolating problems before they cascade. In effect, we have given the globe a digital nervous system, one that can either transmit pain rapidly or respond reflexively to protect the vital organs of civilization.
- **Cascading:** One failure triggers another in a domino effect; this is the hallmark of a polycrisis. AI's speed and scale can turbocharge cascades: An automated trading bot can turn a market dip into a freefall within seconds as AIs amplify each other's actions. Likewise, an AI misreading a sensor might shut down a power grid, which then cripples other systems in quick succession. But AI can also serve as a breakwater, intervening at machine speed to stop dominoes from falling when it detects an impending chain reaction. In this dimension, AI can be both the accelerator of crisis *and* the emergency brake.

In all these dimensions, AI is a force multiplier. It magnifies certain failure modes even as it offers powerful new foresight and response tools. The polycrisis era will be co-written by human and artificial agents together; our challenges and our solutions will increasingly spring from this entwined partnership.

Human and Machine: A Meta-Reflection

It has not escaped our notice that this book itself is an exercise in human–machine collaboration. In the spirit of transparency, we freely admit that much of the manuscript – including this chapter – was developed with AI assistance. It was like having a tireless, hyper-logical assistant by our side. This was more than a convenience; it was a test of our thesis. Can human judgment and machine intelligence meld into something greater than the sum of their parts?

The experience was illuminating. The AI brought speed, breadth, and a knack for pattern-spotting; we humans brought context, conscience, and creativity. Neither could have done this alone. We also learned that delegation is not abdication: Handing some tasks to the machine meant staying vigilant with our own oversight. In a world where algorithms increasingly generate content and choices, **human discernment becomes more critical, not less so**. Our collaboration underscored a hopeful point: With wise guidance, artificial intelligence can augment human capability without eclipsing the human touch. It's a partnership that, if managed with care, could strengthen our collective resilience.

Writing about polycrisis with an AI partner was a small rehearsal for how society might tackle crises with AI on the team. It left us cautiously optimistic. We saw that blending human and machine strengths can yield insights neither could reach alone. But we also saw that how we guide this partnership matters immensely. The lesson is not that AI will save us or doom us, but that **our relationship with it** will shape whether the story of the 21st century is one of resilience or ruin.

Beyond the Horizon: Quantum and Unknown Unknowns

Before we close, let's glance beyond AI at the other wild cards on the horizon.

Quantum computing, for instance, promises to crack problems once thought unsolvable – while possibly cracking our security wide open. An AI amplified by quantum processors could conceivably find cures or climate fixes in a blink, or just as conceivably enable unimaginably swift cyber-attacks. And beyond quantum lie the *unknown unknowns*: Synthetic life forms, unforeseen social shifts, even cosmic surprises. There will always be another disruptive force emerging from the twilight.

We cannot predict every curveball, but we can cultivate the foresight and flexibility to adapt. The polycrisis of today, entangled with AI and whatever comes next, demands continuous learning and adaptive leadership. The lights may dim on one chapter of history, but a new one always begins – full of danger, yes, but also possibility.

In this dimming light, we end not with answers but with a call to intelligent action. The polycrisis is the grand challenge of our age, and AI now threads through its every strand, both a menace and a potential salve. Whether the coming years play out as tragedy or transformation will depend on how we conduct the duet between human and artificial minds. The score remains unfinished, and the baton passes to you. Will we let machines write the crescendo of our crises, or will we, human and AI together, compose a new harmony from the discord? The hour is late, the stakes are high, and the future is listening.

AUTHORS PRESENTATION

Mika Aaltonen is a Ph.D (Economics), Associate Professor (Foresight & Complexity), and author of 20 books. He is also the founder of two pioneering companies: AI Publishing House, arguably the first genuine GenAI organization, built from the scratch on human and machine cooperation, and Sustainable Nation Group that excels in innovation in climate change related analysis and decision-making.

Alf Rehn is Professor of innovation, design and management and Director of CODES (Center for Organizational Datafication and its Ethics in Society) at Syddansk Universitet. He is also a speaker, a strategic advisor, a board professional, an author, and a nap connoisseur. He can be found through his website alfrehn.com – and on most serious social media as @alfrehn.

RESOURCES

Complexity Science

Aaltonen, M. (2011) *Robustness. Anticipatory and Adaptive Human Systems*, Emergent Publications.

Aaltonen, M. (2016) *The Third Lens. Multi-ontology Sense-making and Strategic Decision-making*, Routledge.

Aaltonen, M. (2021) *Education in the 2020s. Hope, and Where It Comes From*, EduKustannus.

Adam, B. (2013) *Timewatch: The Social Analysis of Time*, Wiley.

Arthur, W. B. (1999) *Complexity and the economy*, Science, 284(5411), 107-109.

Axelrod, R. & Cohen, M.D. (2000) *Harnessing Complexity. Organizational Implications of a Scientific Frontier*, Basic Books.

Bergmann, W. (1981) *Die Zeitstrukturen Sozialer Systeme. Eine Systemtheoretische Analyse*, Dunckner & Humblot.

von Bertalanffy, L. (1950) An Outline of General System Theory, *British Journal for the Philosophy of Science*.

Cilliers, P. (1998) *Complexity and Postmodernism. Understanding Complex Systems*, Routledge.

Epstein, J. M. (2006) *Generative social science: Studies in agent-based computational modeling*, Princeton University Press.

Giddens, A. (1984) *The Constitution of Society. Outline of the Theory of Structuration*, Macmillan.

Gilbert, N. (2008) *Agent-based models*, Sage Publications.

Hegel, F. (1807) *The Phenomenology of Mind*, Harper & Row.

Heidegger, M. (1927) *On Time and Being.* New York, Harper & Row.

Holland, J. H. (1995) *Hidden order: How adaptation builds complexity*, Addison-Wesley.

Holland, J. (1998) *Emergence. From Chaos to Order*, Perseus Books.

Humphreys P. (2016) *Emergence: A philosophical account*, Oxford University Press.

Juarrero, A. (1999) *Dynamics in Action. Intentional Behavior as a Complex System*, MIT Press Kauffman, S. A. (1993) The origins of order: Self-organization and selection in evolution. Oxford University Press.

Kauffman, S. A. (1995) At home in the universe: The search for laws of self-organization and complexity, Oxford University Press.

Lévi-Strauss, C. (1966) *The Savage Mind*, London, Weidenfeld & Nicolson.

Lévi-Strauss, C. (1978) *Structural Antropology*, Penquin.

Luhmann, N. (1980) *The Differentiation of Society*, Columbia University Press.

Mandelbrot, B. (1982) *The Fractal Geometry of Nature*, W. H. Freeman and Company.

Mead, G. H. (1934) *Mind, Self and Society. From Standpoint of a Social Behaviourist*, Chicago University Press.

Mead, G. H. (1938) *The Philosophy of the Act*, Chicago University Press.

Meadows, D. H. (1999) *Leverage points: Places to intervene in a system*, The Sustainability Institute.

Miller, J. H., & Page, S. E. (2007) *Complex adaptive systems: An introduction to computational models of social life*, Princeton University Press.

Mitchell, M. (2009) Complexity: A guided tour, Oxford University Press.

Mitleton-Kelly, E. (2003) *Complex Systems and Evolutionary Perspectives on Organizations. The Application of Complexity Theory to Organizations*, Pergamon.

Rehn, A. (2011) *Dangerous Ideas.* Marshall Cavendish.

Rehn, A. (2024) *A Creativity Caleidoscope.* Dvalin.

Rosen, R. (1958) A Relational Theory of Biological Systems, *Bulletin of Mathematical Biophysics*, 245–260.

Rosen, R. (1985) *Anticipatory Systems. Philosophical, Mathematical and Methodological Foundations*, Pergamon Press.

Rosen, R. (2000) *Essays on Life Itself*, Columbia University Press.

Snowden, D. & Boone, M. (2007) A Leader´s Framework for Decision Making, *Harvard Business Review*.

Stacey, R. (1996) *Complexity and Creativity in Organizations*, Berrett-Koehler.

Strogatz, S. (1994) *Nonlinear Dynamics and Chaos. With Applications to Physics, Biology, Chemistry, and Engineering*, Perseus Books.

Strogatz, S. (2004) *Sync: The Emerging Science of Spontaneous Order*, Penguin Books.

Waldrop, M. M. (1992) *Complexity: The emerging science at the edge of order and chaos*, Simon & Schuster.

Wiener, N. (1948) *Cybernetics: Or control and communication in the animal and the machine*, MIT Press.

System Dynamics

Anderson, P. W. (1972) More is different, *Science*, 177(4047), 393-396.

Banks, J., Carson, J. S., Nelson, B. L., & Nicol, D. M. (2009) *Discrete-event system simulation (5th ed.)*.

Barabási, A. L. (2002) *Linked: The new science of networks*, Perseus Publishing.

Barabási, A. L., & Albert, R. (1999) Emergence of scaling in random networks, *Science*, 286(5439), 509-512.

Burt, R. S. (2005) *Brokerage and closure: An introduction to social capital*, Oxford University Press.

Comfort, L. K. (2007) Crisis management in hindsight: Cognition, communication, coordination, and control, *Public Administration Review*, 67(s1), 189-197.

Folke, C. (2006) Resilience: The emergence of a perspective for social-ecological systems analyses, *Global Environmental Change*, 16(3), 253-267.

Forrester, J. W. (1961) *Industrial dynamics*, MIT Press.

Forrester, J. W. (1969) *Urban dynamics*, MIT Press.

Freeman, W. H. & Prigogine, I., & Stengers, I. (1984) *Order out of chaos: Man's new dialogue with nature*, Bantam Books.

Gleick, J. (1987) *Chaos: Making a new science*, Viking Penguin.

Goldstein, J. (1999) Emergence as a construct: History and issues, *Emergence*, 1(1), 49-72.

Johnson, S. (2001) *Emergence: The connected lives of ants, brains, cities, and software*, Scribner.

Lorenz, E. N. (1963) Deterministic nonperiodic flow, *Journal of Atmospheric Sciences*, 20(2), 130-141.

Meadows, D. H. (2008) *Thinking in systems: A primer*, Chelsea Green Publishing.

Morin, E. & Kern, A. B. (1993) *Terre-Patrie*, Seoul.

Newman, M. E. J. (2010) *Networks: An introduction*, Oxford University Press.

Quarantelli, E. L. (1998) *What is a disaster? Perspectives on the question*, Routledge. Rockström, J. et al. (2009). A safe operating space for humanity, *Nature*, 461(7263), 472-475.

Rehn, A. (2019) *Innovation for the fatigued.* Kogan Page.

Rehn, A. (2026) *Crime.* Bloomsbury.

Rittel, H. & Webber, M. (1973) Dilemmas in a General Theory of Planning, *Policy Sciences*.

Sterman, J. D. (2000) *Business dynamics: Systems thinking and modeling for a complex world*, McGraw-Hill.

Taleb, N. N. (2007) *The black swan: The impact of the highly improbable*, Random House.

Tschakert, P., Ellis, N. R., Anderson, C., Kelly, A., & Obeng, J. (2013). One thousand ways to experience loss: A systematic analysis of climate-related intangible harm from around the world, *Global Environmental Change*, 23(5), 957-975.

Walker, B., & Salt, D. (2006) *Resilience thinking: Sustaining ecosystems and people in a changing world*, Island Press.

Watts, D. J. (2003) *Six degrees: The science of a connected age*, W. W. Norton.

Watts, D. J., & Strogatz, S. H. (1998) Collective dynamics of 'small-world' networks, *Nature*, 393(6684), 440-442.

Weick, K. E., & Sutcliffe, K. M. (2007) *Managing the unexpected: Resilient performance in an age of uncertainty (2nd ed.)*, Jossey-Bass.

Zeigler, B. P., Muzy, A., & Kofman, E. (2018) *Theory of modeling and simulation: Discrete event & iterative system computational foundations (3rd ed.)*, Academic Press.

Appendices

APPENDIX A

GLOSSARY OF KEY TERMS

Agent-Based Model (ABM): A computational modeling approach that simulates the actions and interactions of autonomous agents to assess their effects on the system as a whole.

Attractor: In complex systems theory, a set of states toward which a system tends to evolve, regardless of starting conditions within the basin of attraction.

Cascade Effect: A sequence of events where each event triggers the next, often resulting in a large-scale failure or disruption that spreads through interconnected systems.

Complex Adaptive System (CAS): A system composed of many interacting agents that adapt their behavior based on experience, creating emergent system-level behaviors.

Complex Emergency: A humanitarian crisis situation involving multiple factors such as conflict, economic collapse, environmental degradation, and social breakdown.

Complexity Science: An interdisciplinary field studying complex systems and their behaviors, focusing on emergence, self-organization, and nonlinear dynamics.

Compound Crisis: A crisis involving multiple contributing factors that combine to create a single crisis outcome, typically within one primary domain.

Cross-Domain Interaction: The process by which crises or disruptions in one sector influence and interact with other sectors or domains.

Cybernetics: The study of communication and control in systems, particularly feedback mechanisms and regulatory processes.

Diachronic Emergence: Properties that arise over time through the historical evolution of system interactions.

Emergence: The phenomenon where complex systems exhibit properties or behaviors that arise from component interactions but cannot be predicted from studying components in isolation.

Feedback Loop: A process where outputs of a system are routed back as inputs, creating a loop of cause and effect. Can be positive (reinforcing) or negative (balancing).

Fitness Landscape: A metaphorical representation of adaptation where height represents success or fitness of different system configurations.

FONIC: A characterization of the world we live in.

Leverage Point: A place within a complex system where a small shift in one thing can produce big changes in everything.

Network Effect: The phenomenon where the value or impact of a system increases with the number of users or connections within the network.

Nonlinearity: A property of systems where small changes can have large effects, and outputs are not proportional to inputs.

Path Dependence: The tendency for past events and decisions to constrain future possibilities, where the sequence of events matters as much as the events themselves.

Phase Transition: A sudden qualitative change in system behavior that occurs when system parameters cross critical thresholds.

Polycrisis: A dynamic condition where multiple crises interact across different domains, creating cascading effects, feedback loops, and emergent challenges that exceed the sum of individual crisis impacts.

Resilience: The ability of a system to maintain function in the face of disturbances and to adapt and transform when necessary.

Self-Organization: The process by which components of a system spontaneously organize into ordered patterns without external direction.

Sensitive Dependence on Initial Conditions: The property of complex systems where small differences in starting conditions can lead to dramatically different outcomes (also known as the "butterfly effect").

Strange Attractor: A type of attractor in dynamical systems that exhibits complex, seemingly chaotic behavior while following underlying patterns.

Synchronic Emergence: Properties that exist at a particular moment in time due to the current configuration of system components.

System Dynamics: A methodology for understanding complex systems' behavior over time, focusing on feedback loops, stocks, flows, and time delays.

Systemic Risk: Risk that threatens an entire system rather than individual components, often arising from interconnections and dependencies.

Threshold Effect: A phenomenon where gradual changes produce little apparent impact until a critical point is reached, after which rapid changes occur.

Wicked Problem: A policy challenge that is difficult to define, has no clear solution, and where each problem is essentially unique.

APPENDIX B

POLYCRISIS ASSESSMENT TOOLKIT

This toolkit is designed as a **manual**, not a manifesto. You can use it:

- In leadership teams or boards.
- In cross-agency workshops.
- As a structured way to stop people shouting “polycrisis!” at every bad week.

It is built around the **FONIC** lens:

Fragile – Overlapping – Nonlinear – Interconnected – Cascading

FONIC is the structure you use to sort **real polycrises** from **loud but limited disruptions**, and to decide how seriously to engage.

You don’t need software. You need a pen, a table, and colleagues who can tolerate uncomfortable questions.

1. The FONIC Triage: Crisis, Mess, or Polycrisis?

Purpose: Decide whether you're facing a genuine polycrisis or just a nasty problem with good PR. For the situation you're examining, rate each dimension from 0–3.

0 = Not really present.
1 = Minor / local.
2 = Significant / cross-cutting.
3 = Dominant / systemic.

Dimension	Guiding Question	Score (0–3)
Fragile	Are key systems already stretched, optimized, or under-maintained to a brittle degree?	
Overlapping	Are multiple, distinct crisis types occurring at once or feeding into each other?	
Nonlinear	Are small triggers producing disproportionate effects or sudden tipping points?	
Interconnected	Are impacts clearly jumping across sectors, regions, or domains (not staying "in sector")?	
Cascading	Do failures in one place trigger follow-on failures elsewhere?	

Total FONIC score (0–15): _______

Interpretation (rough, but honest):

- **0–4**: *Crisis-shaped noise.* Treat seriously, but don't redesign civilization.
- **5–8**: *Complicated crisis.* Multi-domain, but still largely containable.
- **9–12**: *Systemic entanglement.* Treat as a **polycrisis in progress**; siloed responses will backfire.
- **13–15**: *Full-spectrum polycrisis.* Governance, not PR. You need cross-system leadership, not a taskforce and a hashtag.

You can run this quickly at the start of any executive or cabinet discussion. If people disagree strongly on scores, congratulations: you've just discovered your first governance problem.

2. The "Tangled Web" Map

Purpose: Make interdependence visible in under 30 minutes.

On a blank page, write the crisis trigger(s) in the center.

Then:

1. Around it, draw **eight circles** labelled:
   - Health.
   - Economy / Finance.
   - Environment / Climate.
   - Infrastructure / Utilities.
   - Politics / Institutions.
   - Technology / Cyber.
   - Information / Media.
   - Social Fabric / Trust.
2. In each circle, write **what is already affected** or **at obvious risk**.
3. Now draw **arrows**:
   - From one circle to another whenever you can say:
     "X makes Y worse because …"
4. Put a small ⚠ next to any arrow where the effect is **delayed** (weeks/months/years).

When you're done, ask:

- Which circles are most crowded?
- Which arrows are most numerous?
- Which arrow, if deleted, would simplify the map dramatically?

Those dense nodes and heavy arrows are **your polycrisis hotspots**.

3. Fragility Audit: Where Does It Snap?

Purpose: Identify brittle points before they help everything fall over.

For each major system involved (e.g. grid, health system, ministry, firm, platform), answer:

1. **Single Point People**
   - Is there any process where *one* person's absence would seriously delay action?
   - Names (don't write them in public documents, but know them).
2. **Over-Optimization**
   - Where have we removed buffers (inventory, staff, time) "because of efficiency"?
   - What's running "close to the red line" in normal times?
3. **Maintenance & Debt**
   - What infrastructure or system has known maintenance gaps or "technical debt" nobody likes to discuss?
4. **Invisible Dependencies**
   - List 3 external dependencies that **never** appear on your risk register but absolutely should.
   - Example categories: subcontractors, cloud services, obscure legacy systems, politically sensitive suppliers.

You now have a **shortlist of fragilities**. In a polycrisis, these are the parts that will go first. Plan accordingly.

4. The Cascadometer

Purpose: Rapid sense-check of how likely it is that this thing will spread and mutate.

For each statement, answer yes (1) or no (0).

1. Failure in this system would **immediately** degrade at least **three** other critical functions.
2. Public perception of failure is likely to be **worse** than the technical reality.
3. We rely on **the same vendor / platform / institution** in multiple "unrelated" areas.
4. Some actors can **improve their own position** by letting this crisis spread.
5. Our playbooks assume that **only one major thing goes wrong at a time**.

Score: 0–5

- **0–1**: Cascades unlikely, but monitor for surprises.
- **2–3**: Cascades plausible. Build "circuit breakers" fast.
- **4–5**: Cascades almost guaranteed. Shift from incident response to system management.

If you score 3 or more and your FONIC score is above 9, you are **not** in a normal crisis. Stop treating it like one.

5. Time Lens: Now, Next, Later

Purpose: Escape the tyranny of "right now" thinking.

On three separate lines, complete these prompts:

- **Now (hours–days):**
  If we do nothing different in the next 48 hours, what **definitively gets worse**?

- **Next (weeks–months):**
  If we fix the headline problem, what **secondary problems** will we have created or worsened?

- **Later (years):**
  If we respond the way we're currently planning, what will a smart historian say was **short-sighted**?

Then ask:

- What one action helps across **all three** time horizons?
- What action clearly solves **Now** while actively sabotaging **Next** and **Later**? (Mark that one in red and reconsider.)

Polycrises are time-weird: recovery in one domain often overlaps with escalation in another. This tool keeps you honest.

6. Narrative & Information Scan

Purpose: Diagnose the information environment before it quietly wrecks your response.

Fill these in:

- **Official Narrative**
  - In one sentence, what is the story we are telling about this crisis?
- **Alternative Narratives**
  - List at least three others currently circulating (media, social media, opposition, conspiracy forums).
- **Gaps & Tensions**
  - What is **true** in those alternative narratives that ours ignores?
  - Where are we clearly over- or under-promising?
- **Information Chokepoints**
  - Who controls the key data streams?
  - Where could legitimate information be delayed, distorted, or silenced?

If your narrative scan finds large gaps between **what is happening** and **what you're saying**, you have the seed of a legitimacy crisis on top of everything else.

7. Stakeholder Grid: Who Helps, Who Hinders?

Purpose: Understand who matters in this polycrisis, beyond the organization chart.

Draw a 2×2 grid:

- X-axis: **Influence** (low → high).
- Y-axis: **Alignment with constructive response** (low → high).

Now place in:

- Government actors (ministries, agencies, regulators).
- Key firms and sectors.
- Civil society / unions / NGOs.
- Technical experts / professional bodies.
- Media / platforms.
- Informal networks (activists, community leaders, online influencers, "the people who always fix things quietly").

Then ask:

- Who is **high influence, low alignment**? That's your risk.
- Who is **low influence, high alignment**? That's your underused asset.
- Which stakeholders **must** be moved into the top-right quadrant (high influence, high alignment) for this not to spiral?

This is where polycrisis becomes political: you are not just managing events, you are managing coalitions.

8. Designing Interventions with FONIC

Purpose: Use FONIC not as a slogan but as a design checklist.

For each major proposed intervention (policy, measure, communication, reconfiguration), run through:

1. **Fragile**
   - Does this make any system more brittle (e.g. cutting "redundant" staff, centralizing further, overloading a single actor)?
   - Can we alter it to **add** buffers rather than remove them?
2. **Overlapping**
   - Which **other crises** does this touch (climate, inequality, trust, security)?
   - Does it mitigate more than one, or trade one off against another? Can we improve the ratio?
3. **Nonlinear**
   - Where might this intervention have **disproportionate** effects (positive or negative)?
   - Are we comfortable with that leverage?
4. **Interconnected**
   - What hidden dependencies does this create (e.g. on one supplier, one region, one platform)?
   - Are we increasing concentration risk?
5. **Cascading**
   - If this fails, **how** does it fail? Silently and locally, or loudly and everywhere?
   - Can we build in circuit breakers, reversibility, or graceful degradation?

If an intervention looks good on paper but makes you wince on three or more FONIC dimensions, it is **not** a resilience measure. It's a future crisis application form.

9. The Polycrisis Simulation Prompt Sheet

Purpose: Use this book's logic in workshop or tabletop exercises.

When designing a simulation or tabletop exercise:

1. **Stack at least two crisis types.**
   - E.g. cyber + flood, drought + political scandal, financial stress + heatwave.
2. **Force cross-sector coordination.**
   - Require at least four different stakeholder groups to make joint decisions.
3. **Introduce nonlinear twists.**
   - A small overlooked detail becomes critical mid-scenario (e.g. a minor supplier, a quiet regulation, an ignored data source).
4. **Inject narrative volatility.**
   - Halfway through, change the media storyline or global attention. How does that shift decisions?
5. **End with FONIC reflection.**
   - Ask participants to score the simulated crisis using the FONIC Triage (Section 1).
   - Then ask: *What did we assume would stay stable that actually didn't?*

10. Last Page Reminder

When in doubt, come back to three questions:

1. **Is this truly a polycrisis, or are we just overwhelmed?**
   Use FONIC to decide.
2. **What are we accidentally making more fragile as we respond?**
   Use the Fragility Audit and FONIC design lens.
3. **Who else should be in the room before we touch anything important?**
   Use the Stakeholder Grid and Narrative Scan.

If you can't answer those, don't comfort yourself by calling it "unprecedented."
You're not in unprecedented times. You're in **poorly instrumented times**.

This toolkit is your attempt to fix that. On paper, admittedly. But all serious revolutions in thinking started on paper.